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# BOVINE OBSTETRICS

BY

M. G. DE BRUIN

INSTRUCTOR OF OBSTETRICS AT THE STATE VETERINARY SCHOOL IN Utrecht

TRANSLATED BY

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AUTHOR OF "THE CLINICAL DIAGNOSIS OF LAMENESS IN THE HORSE"; "DOUBLE  
TIBIO-PERONEAL NEURECTOMY FOR THE RELIEF OF SPAVIN LAMENESS."

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## AUTHOR'S PREFACE.

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Within the past decades several works discussing Veterinary Obstetrics have been issued. I refer to the text-books of Baumeister-Rueff, Harms, Lanzillotti-Buonsanti, St. Cyr and Violet, Sjöstedt, Franck-Göring, Fleming and Deneubourg, who treated the subject in detail.

The fact that I had to deal exclusively with bovine obstetrics, induced me to accept Professors Dr. Bayer and Fröhner's suggestion to write this work.

A specialized treatise on bovine obstetrics demands a rather broad presentation, as it is most frequently met with in obstetrical therapy. Taking this fact into consideration, certain sections were treated in detail,—for instance, abortion, torsion of the uterus, dystokia from malpositions and parturient paresis. Embryotomy also was fully dealt with, since many years of experience have shown me the important rôle it plays in a bovine obstetrical practice, and an exhibition of the various methods, especially in regard to the beginner, are desirable. The supplement, "Auxilliaries in the Study of Mechanical Obstetrics," reviews the manner by which the students, in comparatively short time, may acquire some dexterity in reposition and embryotomy.

Most of the illustrations are original; only Figs. 13 and 74 are taken from Skellet's work ("A Practical Treatise on the

Parturition of the Cow"); Figs. 16 and 25 I owe to the kindness of Messrs. Fricker and Fröhner.

As regards the balance, the work must speak for itself. In conclusion, I thank all who so kindly aided me in the elaboration and translation; I also take this opportunity to express my profound thanks to Prof. Dr. Fröhner for revising the proof sheets.

M. G. DE BRUIN.

Utrecht, May, 1897.

## TRANSLATOR'S PREFACE.

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When the text book of "Veterinary Surgery and Obstetrics," edited by Profs. Dr. Bayer and Fröhner, with the collaboration of the leading authorities and specialists of Europe, first presented itself, the importance of an original, exhaustive, practical modern discourse, written by eminent obstetrical specialists, became apparent.

Since 1877 and 1895 respectively, the English speaking student has been referred to a compilation, to which we all bow in thankfulness, fully recognizing the endeavors Professor George Fleming made in behalf of the Veterinary Profession and stock breeders at that time.

Since then scientific research has changed many of the old theories and given birth to innumerable new facts, playing mainly into the field of pathology and therapeutics; for instance, the pathology and therapy of abortion, puerperal infection, parturient paresis, enzootic diseases of calves, etc.

The progressive spirit of the publisher, Wm. R. Jenkins, whom the profession owes already so much, enables me to present to the English speaking Veterinary Profession an authorized translation of the "Bovine Obstetrics" written by Professor M. G. de Bruin, who, as a scientist and bovine obstetrical specialist, is too well known to require further introduction. No apology, therefore, is necessary in offering

for acceptance the independent obstetrical branch of Profs. Dr. Bayer and Fröhner's text book on veterinary surgery and obstetrics. Its scope and arrangements, having met the requirements of European teachers, students and practitioners, cannot fail to meet those in English speaking countries.

Encouraged by the reception given my "Clinical Diagnosis of Lameness in the Horse," I have devoted limited moments of leisure to the translation of the Bayer-Fröhner work, being confident that Prof. de Bruin's obstetrical treatise will improve obstetrical teaching and reading.

W. E. A. WYMAN.

Milwaukee, Wis.

Dedicated  
TO MY  
FRIEND AND TEACHER  
DR. M. H. MCKILLIP  
THE TRANSLATOR



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## **A.—NORMAL PREGNANCY.**

---

### **I.**

#### **CHANGES TAKING PLACE IN THE UTERUS FROM CONCEPTION TO DEVELOPMENT OF YOUNG.**

##### **1.—Œstrum and Conception.**

The development of the young begins as soon as the mature ovum comes in contact with the vitalizing fluid. In the female an ovum capable of fecundation is only found at the age of puberty.

The age of puberty in the cow varies. In the finely bred animal this period may be induced to set in earlier by intensive feeding, proper care, and careful selection of the parent. It even may become inherited, provided the succeeding generations live under the same favorable conditions. Puberty of the cow is usually present some time before the animal is allowed to be served. From the agriculturist's standpoint, it is desirable to have the first calf come in the two-year-old female. Some even require the heifer to be three years old before she gives birth. A great many points are in favor of the latter age. Experience teaches that delivery is easier when the pelvis is not too young and the various diameters are in proper relation to each other. At the same time cows develop better, thus being of greater value in old age, doing good service until ten to twelve years old.

The act of parturition in the two-year-old is often difficult on account of the narrow and juvenile pelvis, and the value of the cow deteriorates sooner. The dairyman, especially one with limited capital, demands the first calf at two years, in order to utilize the milk as soon as possible. When fed and cared for properly, the disadvantages of an early pregnancy

may be diminished to such an extent as to make this a valuable method of breeding.

The Holstein usually bears the first calf at two to two and one half years, when lactation begins. The animal, therefore, is served when fifteen to twenty months old. It is not rare—in fact, it is the rule—to get three thousand quarts of milk at the first lactation, the quantity increasing to six thousand quarts and more with the second calf. On an average, the cow reaches puberty at ten months. Nevertheless, it may occur at five to six months and conception take place. Some years ago I performed embryotomy in a thirteen months old heifer. The calf was of normal size and too large for this female, and for this reason embryotomy was performed. The calf without intestines and skin weighed fifty pounds. The heifer stood the operation well, and became a good milker.

The best age to serve the cow may be said to be at one and a half to two years.

During puberty, at certain intervals, ripe ova leave the ovary, which, on reaching the Fallopian tube, either are fertilized or succumb, depending whether coition takes place or not. This process, characterized by a series of phenomena, is known as oestrus. Of the visible signs one may mention: The whole behavior changes; the cow runs about with the tail elevated, bellows and rides other cows; she may leave the pasture to get near the bull; appetite as a consequence of the excitement is diminished, and the urine is passed in small quantities. The local examination reveals hyperæmia of the genital organs, especially the vulva; it is swollen, and in animals with light skin a slight redness is noticeable. Now and then a little blood or reddish mucus flows from the vulva, to adhere and coagulate on the long hair of the inferior commissure. At times the hemorrhage is considerable, so that it may be termed a true *menstruation*. (Numan.)

The udder also changes, showing some swelling. During the period of lactation the quantity of milk decreases and its character changes; it does not churn well and resembles colostrum. Occasionally oestrus is only recognized by a small

flow of bloody mucus from the vulva; this is known as "still bulling." The beginning of oestrus is indistinct, reaches its height in a cow in twenty-four hours, and then declines. At the outset of oestrus the female does not take the bull. The period of oestrus in the cow is twenty-four to thirty-six hours. In case conception does not take place, it repeats itself every three weeks. Whenever conception takes place, it is, as a rule, wanting during pregnancy. Four weeks after parturition oestrus appears. Although no definite time exists for conception, it seems to occur more readily in spring. During oestrus weak uterine contractions occur, which open the cervix sufficiently to permit the introduction of a finger. As a consequence of these contractions a mummified foetus may be expelled. Some cases are on record where a cow was covered during the period of oestrus. The following day a dried foetus was expelled; nevertheless the animal remained pregnant (Franck). As previously stated, oestrus represents a series of symptoms arising from the ovaries and of great importance to us.

At an early age—in the foetal ovary—the Graafian follicle has been proved to exist. During puberty a decided hyperæmia of the ovary occurs, and one or more follicles enlarge and project above the ovary, giving the latter the appearance of a mulberry, and at this moment "the Graafian follicle is matured." The Graafian follicle bursts, and the ovum is received by the fibrillated extremity of the oviduct. The pavilion of the tube containing non-striated muscular tissue grasps the ovary with its fimbriæ.

The ovum is a cell with a diameter of  $\frac{1}{10}$  to  $\frac{2}{10}$  mm., and consists of a rather thick and transparent membrane (vitelline membrane, zona pellucida), and its contents, the yolk or vitellus, made up of a number of granules joined by a viscid fluid. The vitellus contains the germinal vesicle and the germinal spot. Studies within the last few years show that the egg cell undergoes a number of microscopical changes before fecundation can take place.

*Corpus Luteum.*—When the Graafian follicle ruptures and

empties, a cavity should be formed. Such is actually the case, but it is filled immediately with blood from the vessels in its wall. It is a hemorrhage per rhixin. The blood coagulates, the site of rupture closes, and the coagulum becomes incarcerated. The inner lining of the Graafian follicle granulates and forms a number of young connective tissue cells in the coagulum. The greater part of the coagulum is absorbed and replaced by young connective tissue. The remaining pigment causes a yellow or orange tinge of the connective tissue mass, for which reason the body replacing the Graafian follicle is termed "yellow body" (corpus luteum). When impregnation follows, and thus the periodical hyperæmia of the ovum ceases, regression of the corpus luteum is manifested, yet it can be recognized shortly before gestation ends. When fecundation does not take place and periodical ovarian hyperæmia appears every three weeks, the coagulum is absorbed and a little scar tissue forms. The hyperæmic condition of the genital apparatus is looked upon as a reflex act, induced by the pressure of the Graafian follicle upon nerve endings causing an irritation of the vaso-dilators. This congested state causes a mucoid fluid, containing many leucocytes and fat globules, to be thrown off by the mucosa of the Fallopian tube. In this liquid the fecundated egg rests. (Franck.)

#### CONCEPTION.

During coition the penis in all probability enters the cervical canal, and the semen is poured into the uterine cavity. The spermatozoa may reach the egg either by their own movement or the antiperistalsis of the uterus and tubes. At the moment of ejaculation and already previously the uterus contracts, thus narrowing its lumen. Later the uterine muscle relaxes, a negative pressure, and aspiration of the semen follows, which is now carried to the oviduct by the factors already enumerated.

This is a rather rapid process, as one hour after coition spermatozoa can be detected in the Fallopian tube (Franck).

The egg, having left the ovary and resting in the oviduct, on coming in contact with the spermatozoa may now become fecundated to undergo various changes. In most cases fecundation takes place in the pavilion, rarely in the ovary, to be discussed later under "Extra Uterine Pregnancy." Numerous conditions may interfere with impregnation, and sterility occurs. Conception, for instance, may be prevented when the semen does not meet the ovum; other causes may interfere with coition.

*Retention Cyst of the Vulvo-Vaginal Glands* (the glands of Bartholin).—This cyst, of potato to fist size, is situated on the lateral vaginal wall near the labiæ, and filled with a thick, slimy, brownish fluid containing blackish lumps. This obstacle is easily obliterated by incising the cyst wall, after-treatment not being necessary.

*Tumors in the vagina* interfere with coition. They are usually pedunculated leiomyomata, frequently located at the inferior vaginal wall of the vaginal portion of the uterus.

*Adhesions of the vaginal walls*, resulting from an injury to the mucosa of the genital canal, caused by too frequent service of the heifer.—Vogt described this affection first in 1878; later Harms, in his work on obstetrics. Lately this traumatic colpitis has been observed by many veterinarians. By it we understand lesion of the mucous membrane and deeper layers of the vagina, the result of coition, leading to pus formation, adhesions, or even septicæmia. This traumatism is mainly seen in heifers running with young bulls. After they become impregnated, heat occasionally returns, because the fecundated egg succumbs. As a result of repeated coition a vaginitis sets in. The patient stands about with arched back, the vulva is œdematosus, they strain continuously. A bloody, slimy, or purulent fluid flows from the vulva; appetite and rumination are more or less decreased. The temperature is now normal and then elevated. Unless such animals are treated, emaciation takes place shortly, and local examination three to four weeks later reveals adhesions of the walls of the vagina, and posteriorly to it a thin fluid manifested by fluctua-

tion is noticeable (Pyocolpos). The quantity of pus may amount to five or six quarts.

Early attention results usually in complete recovery. The treatment consists of astringent and disinfecting injections. Of special value are a 2 per cent. solution of alum, or a 1 per cent. pyotanin. Should adhesions and accumulations of pus be present, the wall is to be perforated with a trocar and the opening enlarged with a finger; this is followed by ordinary surgical treatment. Experience teaches that such animals are often of little value as breeders.

*Vaginismus or Elytropasmus.* — From an etymological standpoint this name is correct. It indicates a spasm of the vaginal constrictor muscle, caused by a hyperesthesia of that portion where the vestibule joins the vagina.

Wagenheuser first observed this affection in the cow. According to his opinion, it is a neurosis with abnormal irritability of the vaginal inlet, a part richly endowed with sensory nerves. In man this disease was first described by Marion Sims. This hyperesthesia produces reflexly, by the slightest stimulus, contractions of the constrictor cunni muscle, even of the pelvic muscles. By it the introduction of the penis into the vagina is interfered with.

The mucosa of the vagina is injected, slightly red, but no catarrh is present. If the hand is introduced into the vagina, the patient trembles, collapses and falls down. A mere touch of that part is often sufficient to bring on these spasmodic contractions.

Similar symptoms accompany micturition. The animal crouches with pain, but does not strain. The urine flows frequently and in small quantities. Post mortem examination does not show any pathological changes in the genital apparatus.

One also meets with cases where copulations are not followed by conception; the spermatozoa then do not come in contact with the ovum. This occurs when the os uteri is obstructed, frequently the case in the cow. In consequence of the inspissated semi-liquid secretion of the palma plicata, the

surfaces of the mucous membrane adhere, thus preventing fecundation.

*Therapeutics* demands the removal of the mucus and the opening of the os uteri with the finger or dilator. Sterility may also be caused by occlusion of the ovarian extremity of the Fallopian tube (Harms), absence of os uteri, uterus (Hekmeijer), or chronic endometritis.

## 2.—The Process of Evolution of the Uterus.

As soon as conception takes place the uterus undergoes numerous changes, enabling it to fulfil its task, primarily noticeable in the mucous membrane. Hypæmia, which sets in during oestrus, continues, also increased secretion and desquamation. The greater amount of blood causes increased metabolism, increased nutrition and hypertrophy of the organ, increasing in ratio with the dimensions of the embryo, which is known as foetus at the moment circulation within it is completed. In single pregnancy, the fecundated horn, if twins, both cornua usually increase in size.

As pregnancy advances the uterus increases in size and changes its position. In the latter stages it lies in the right inferior abdominal region, as the rumen extends from the left flank to the right lower lateral region. The uterus is related on the left to the rumen, on the right it rests against the abdominal parietes. The anterior free end, not supported by the broad ligaments, is covered by the great omentum. The broad ligaments simply enclose the non-pregnant uterus. They continue to carry blood vessels to the uterus, which often become greatly enlarged; the lumen of the uterine artery, for instance, increases four to five times, the smaller vessels become quite large and the network of lymph vessels expands. The broad ligaments become broader and longer, numerous muscular fibres form and unite into broad, muscular bands. Increase of size of the uterus is accompanied by a very slight decrease in the thickness of its wall, which is entirely out of proportion to the increase in size; thus, hyper-

plasia, hypertrophy, or both must take place. The outer layer of the uterus is formed by the serosa, which may be considered of peritoneal origin. The part toward the abdominal cavity is an endothelial layer; the layer below it is united to the muscularis. The muscularis is composed of two

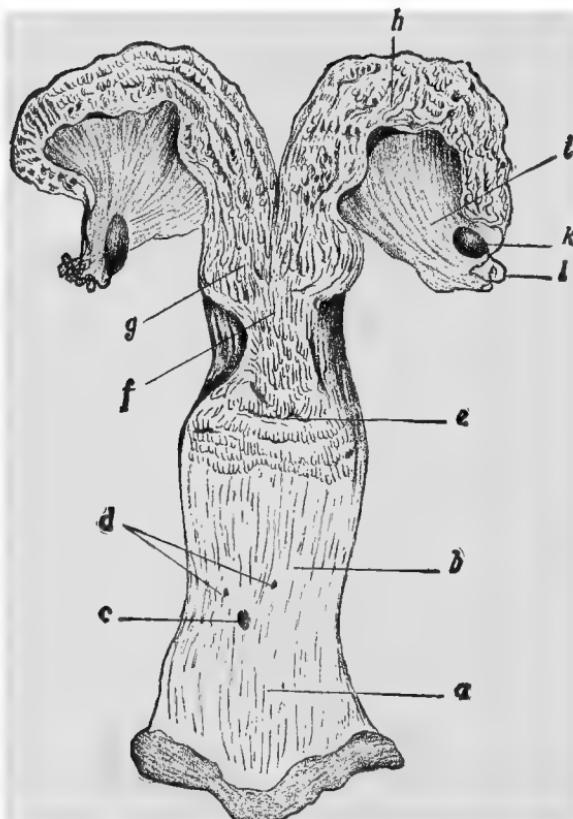


Fig. 1.—Sexual Organs of the Cow.

a, Cavity of the vulva; b, vagina; c, urinary meatus and its valve; d, canals of Gaertner; e, external os of uteri; f, internal os of uteri; g, body of the uterus; h, empty horn; i, broad ligament; k, ovary; l, oviduct.

layers, an outer or longitudinal one, an inner concentric or circular one. The former is continued through the os uteri into the vagina. During pregnancy the muscular elements of the uterus increase in size.

## LENGTH (L) AND WIDTH (B) OF MUSCLE CELLS OF BOVINE UTERUS (IN MICROMILLIMETERS).

## PROCESS OF EVOLUTION OF THE UTERUS

Non-pregnant Uterus		6 Weeks		10 Weeks		12 Weeks		18 Weeks		21 Weeks		5½ Months		8 Months		At the end of pregnancy		14 Days post partum	
L.	B.	L.	B.	L.	B.	L.	B.	L.	B.	L.	B.	L.	B.	L.	B.	L.	B.	L.	B.
83	2.8	281	3.2	384	3.2	396	3.6	576	4.0	768	6.4	599	6.0	691	4.8	714	6.0	89	3.2
89	2.8	371	2.4	460	4.0	460	4.0	614	4.8	755	4.8	652	6.4	665	3.2	806	6.8	204	2.8
89	3.2	384	3.2	384	4.4	512	4.8	640	3.2	832	6.0	819	6.4	768	6.4	652	5.2	102	3.6
160	3.6	307	3.6	448	3.6	471	3.2	627	4.0	780	4.0	763	4.8	819	6.0	857	5.6	115	4.4
89	256	422	524	524	524	524	524	678	678	678	678	883	755	755	128	140	76	140	
102	320	448	550	448	652	652	652	652	599	793	793	793	768	768	768	140	76	140	
140	384	422	652	524	524	524	524	691	704	704	704	691	691	691	691	704	64	64	
115	384	460	691	614	614	627	627	844	844	806	806	704	704	704	704	704	64	64	
108	320	371	460	588	742	832	832	727	727	727	727	742	742	742	742	102	102	102	
76	422	448	614	512	883	883	883	727	727	727	727	844	844	844	844	128	128	128	
89	371	422	448	409	793	819	819	793	793	793	793	727	727	727	727	166	166	166	
179	358	396	537	435	780	780	780	780	780	780	780	714	714	714	714	179	179	179	
166	307	409	512	537	806	755	806	806	806	806	806	665	665	665	665	115	115	115	
134	409	435	550	524	832	657	657	657	657	657	657	704	704	704	704	153	153	153	
AVERAGES																			
115	3.1	345	3.1	422	3.8	524	3.9	537	4.0	755	5.5	727	5.9	755	5.1	742	5.9	115	3.5

According to Kilian, the increase of volume during pregnancy depends on an increase in numbers and size of the muscular elements. Kolliker traces the evolution of the uterine muscle in the beginning of gravidity both to hyperplasia and hypertrophy. According to him, the former only is of importance after the fifth month. Already at the end of the sixth month he found muscle cells of  $\frac{1}{10}$  to  $\frac{1}{4}$  mm. in length, in all the layers of the muscularis.

Reichman measured numerous muscle cells of the gravid uterus at various stages in the physiological laboratory of the Utrecht Veterinary School. For this purpose he took small pieces of the uterine wall of slaughtered pregnant animals and removed the mucosa and serosa. The further pregnancy had advanced the easier was the isolation of the uterine muscle,—in all probability due to an increase of loose connective tissue between the layers. The muscle was cut into little pieces of 7 mm. and macerated in 30 percentic nitric acid; 48 hours later rinsed in distilled water, the water renewed and the little pieces shaken in it. This isolated the muscle cells the easier the further pregnancy had progressed. The muscle cells of the empty uterus appear spindle shaped, somewhat swollen in the middle while the ends are pointed, the nucleus is long. Cells with several nuclei were not observed; after the twenty-first week smaller muscular elements became also noticeable. The measurements proved that as pregnancy advances the muscle cells increase more in length than in width. Up to the twenty-first week both length and thickness increased; after that period the diameter remained stationary. Therefore the increase in size of the uterine muscle up to the fifth month must be attributed to hypertrophy; later, new muscle cells appear, and then only hyperplasia can be spoken of. The mucosa undergoes the most important changes, especially where the fecundated ovum develops. A new organ is formed, or rather a number of new formations arise, the placentæ maternæ. These growths, all built alike and forming together the placenta, regress after parturition, and the mucous membrane of the uterus returns to its original state.

In the non-pregnant uterus, in the Fallopian tube are found numerous small prominences resembling scars or warts; their color is lighter than that of the uterine mucosa; they are of a longish shape, their long axis being at a right angle to the long axis of the tube. In cows which have borne several calves they are more distinct than in the heifer. These are the cotyledons, or carunculæ; into their surface the villi of the chorion are inserted. During pregnancy follicles form at the site of the cotyledons. Each mass of follicles enlarges, becomes movable and pedunculated. Since the cow has

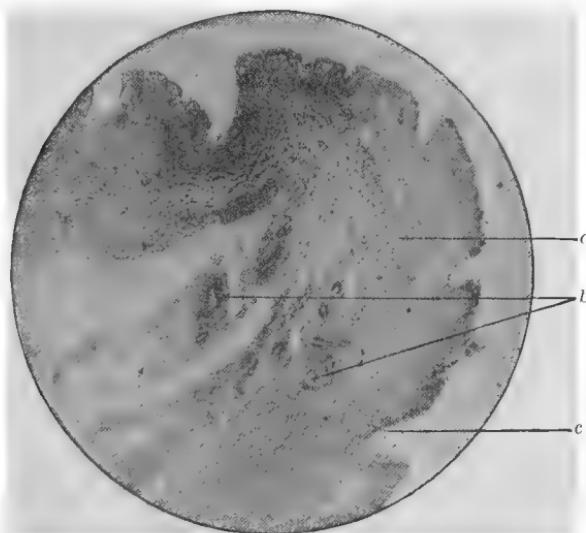


Fig. 2.—Cotyledon of a non-pregnant Uterus, cross section. (Mag. 57).  
a, Ciliated epithelium; b, connective tissue with several cells; c, blood vessels.

numerous cotyledons in every tube—40 to 60—respectively placentæ maternæ, one speaks of a multiple placenta (*placenta multipla*). The cotyledons are convex. Their surface shows numerous depressions and is covered with pavement epithelium. The cotyledons do not contain any muscle tissue: this is very important to explain the expulsion of the afterbirth in the cow. It will be discussed fully (retention of the afterbirth) under its proper head. When single placentæ, respect-

ively cotyledons, are situated about the internal opening of the os uteri (*orificium uteri internum*), a placenta prævia—so termed because it is first detected on exploring the cavity—is formed (Franck). Besides the larger follicular masses (cotyle-

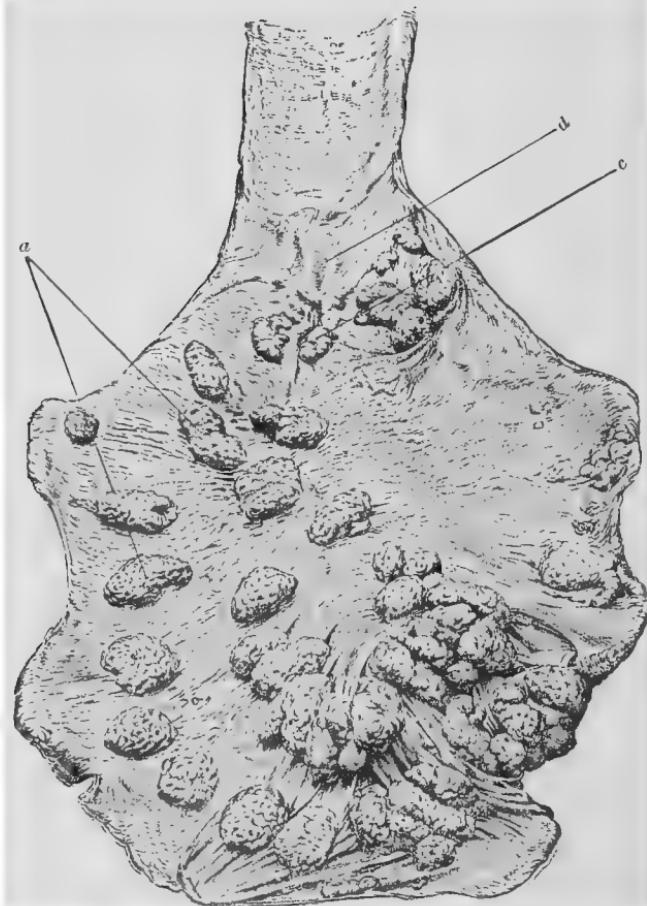


Fig. 3.—Pregnant Uterus, with Cotyledons.

*a*, Maternal placenta; *b*, cervical canal; *c*, placenta prævia, or accessory cotyledons, one also finds a number of mulberry-like prominences of the same structure as the placenta uterinæ, and which are also capable of executing the functions of the cotyledons. For

this reason they are known as accessory placentæ (*placentæ*

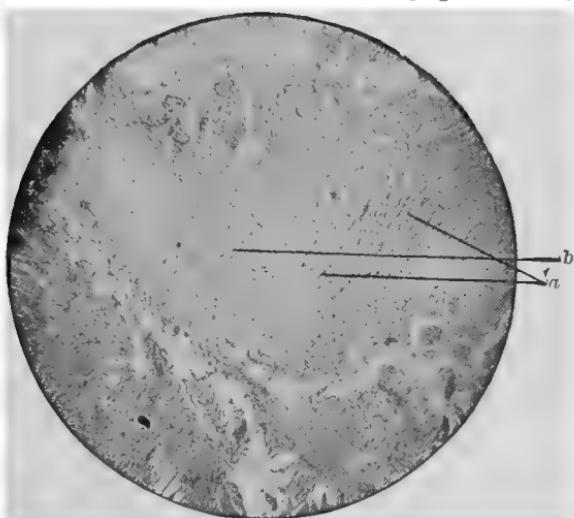


Fig. 4.—Cotyledon of a Pregnant Uterus, cross section.

*a*, Blood vessels; *b*, possibly glands, resembling on first sight the mammary glands.

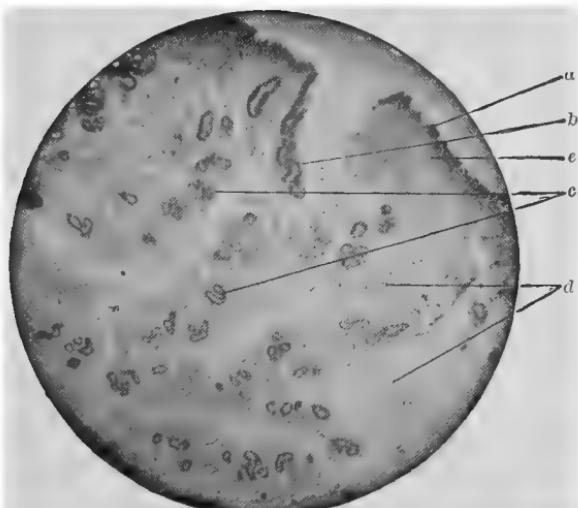


Fig. 5.—Uterine Wall with Glands, not pregnant. (Mag. 57.)

*a*, Ciliated epithelium; *b*, uterine glands (longitudinal section); *c*, cross section of uterine glands; *d*, blood vessels; *e*, submucous connective tissue.

*accessoriae*). That these placentæ really can replace the cotyledons, a case described by St. Cyr and Violet indicates:

A primipara suffering with prolapsus uteri had nearly all the cotyledons destroyed, and in order to prevent hemorrhage and infection each cotyledon was ligated and removed. Next reposition of the prolapsed uterus was effected, the animal recovering shortly. One year later the cow gave birth to a healthy calf without assistance.

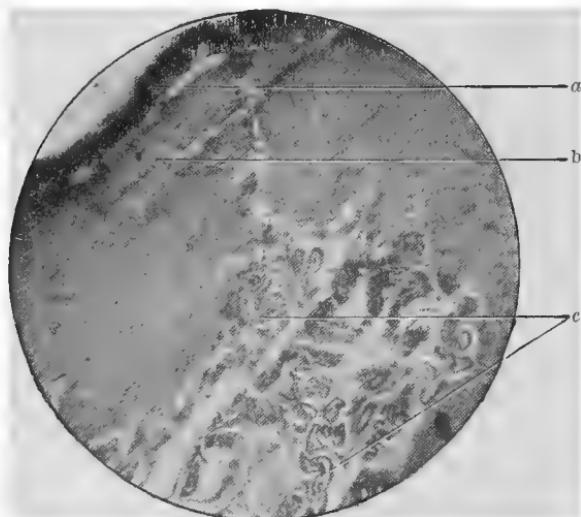


Fig. 6.—Uterine Walls with Glands, pregnant. (Mag. 57.)  
a, Mucosa; b, sub-mucosa; c, glands.

Our literature enumerates several cases where pregnancy again occurred after forcible removal of the cotyledons. On the surface of the cotyledons union with the chorion takes place; into the depressions of the placentæ maternæ the villi of the placentæ foetalis are inserted. The uterine glands (*glandulae uterinæ*), somewhat wave-like in the non-pregnant uterus, enlarge during pregnancy by throwing out bud-like processes; the excretory duct is of a corkscrew shape.

## II.

## THE FŒTUS AND ITS ANNEXES.

## 1.—The Annexes of the Fœtus.

At the moment the product of conception possesses all its organs, it is termed a *fœtus*. The fœtus is surrounded by

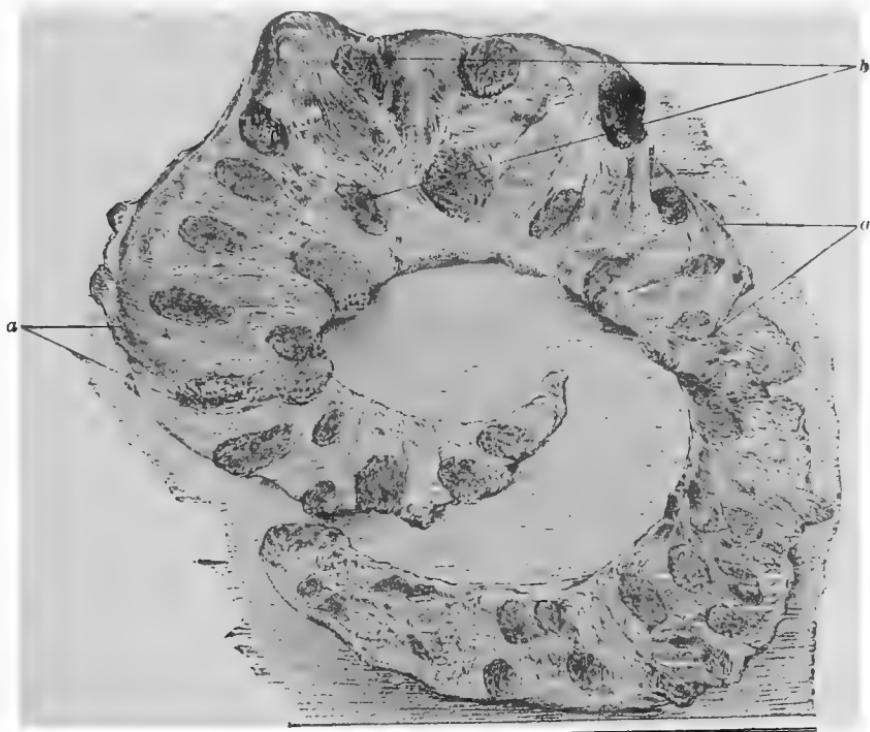


Fig. 7.—Fœtal Membranes.

*a*, Amnion; *b*, fœtal placenta.

its annexes, protecting it against external influences, insuring nutrition and union with the mother. They are: the *chorion*, with the *placenta fœtalis*; the *amnion*, the *allantois*, or so-called *fœtal urinary bladder*; the *umbilical vesicle* and the *umbilical*

*cord.* The foetal membranes are the chorion, amnion and allantois.

#### THE CHORION.

The chorion, or vascular membrane, is the outer envelope surrounding the foetus and the two inner membranes, and adapts itself closely to the outer surface of the mucous membrane of the uterus. Its inner surface is partly loosely united to the outer layer of the allantois and partly closely related to the amnion, viz., that portion opposite the back of the foetus. It has very many blood vessels, which eventually ramify in the placentæ.

The chorion has a greater surface than the mucosa of the fecundated horns. For this reason it is situated in the non-impregnated horn and body of the uterus. When a pregnant uterus and contents, for the sake of demonstration, are placed upon a table, and the wall of the uterus is carefully incised down to the chorion and the incision carried over the whole convexity, one notices that the chorion is folded here and there and that quite a large piece can be removed from the non-impregnated tube. The uterine portion of the chorion in the beginning of the foetal period possesses a number of dark-brown villi. Between these villi the chorion is smooth and transparent. For this reason Franck terms the smooth portion *chorion lœvis*, and the villous one, *chorion villosum*. Those villi opposite to the cotyledons develop more and more to form the foetal placentæ (*placentæ foetales*); they belong, therefore, to the chorion. The foetal and maternal placentæ are present in equal numbers. They rest upon the chorion, non-pedunculated, and each foetal placenta surrounds the maternal placenta, its outer surface therefore being concave. The size of the foetal placentæ varies. The larger ones in the highly pregnant animal are 10 cm. long and 5 to 6 cm. wide. When loosened from the maternal placentæ and spread out they have a diameter of 14 cm. and 7 cm. respectively. The smallest ones are of the size of a mulberry.

The foetal placenta is made up of a number of vascular

villi. Each villus consists of a thin connective tissue layer

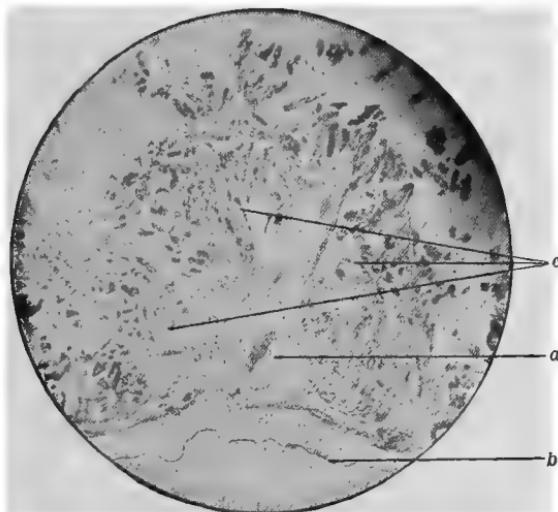


Fig. 8.—Chorion Papillæ. (Mag. 57.)

**a**, Blood vessel with red blood corpuscles; **b**, epithelium; **c**, papillæ.

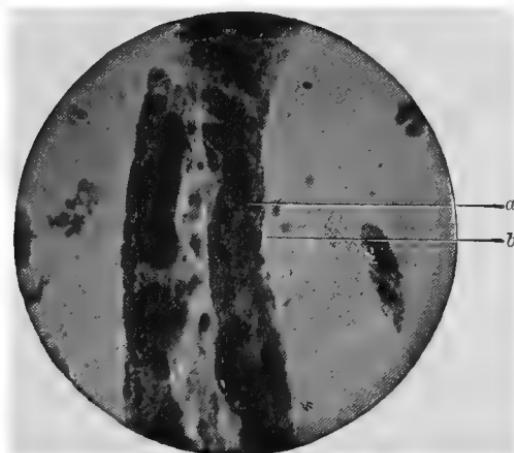


Fig. 9.—Chorion Papilla. (Mag. 1020.)

**a**, Epithelium, with capillary vessel; **b**, white, transparent, bright strip, possibly uterine milk.

and capillary layer, and externally of a layer of pavement

epithelium. Each villus dips into a depression of the maternal placenta. Since the villi of the latter are similarly constructed, it is readily seen that the capillaries of the chorion and of the uterine mucous membrane, respectively *placentæ maternæ*, are separated from each other by a double layer of epithelium. (Franck.)

The *placentæ* unite mother and foetus. Of course there is no direct vascular communication, but the blood vessels adhere intimately to each other, the length and great number of villi thus producing an extensive surface. Upon the chorion *lævis*—the portion between the *placentæ foetales*—are found here and there agglutination of villi. Franck terms these *placentæ accessoriæ*, as they can replace the *placentæ*. In fact, it seems when many cotyledons are wanting, these *placentæ accessoriæ* of the chorion can establish union with the same *placentæ* of the uterus and nourish the foetus.

Strebel mentions a case where the regular foetal *placentæ* of the chorion were absent while the surface was covered with villi. These wart-like projections of grain size were red. This placenta resembled the one of the mare. Exploration of the uterus after parturition showed that its normal cotyledons were absent and replaced by analogous elevations representing the *placentæ maternæ*.

#### COTYLEDONOUS FLUID, OR UTERINE MILK.

On the surface of the cotyledons of the cow is found a fluid which must be looked upon as an emulsion. It is a whitish, reddish emulsion of alkaline or neutral reaction, of a specific gravity of 1.036. It contains cylindrical epithelium, roundish, multi-nuclear cells, many fine fat globules and salts.

Gamgee found in 1000 parts of uterine milk:  $H_2O$ , 879.1; solids, 120.9; albumin with the cells, 104; alkaline albuminates, 1.6; fats, 12.33; organic salts, 3.74; also kreatin, kreatinin and xanthin.

Colin removed of a calf foetus weighing 5.9 kg. 765 g., and of a grown goat foetus 285 gr. (Franck.)

As to the importance of this fluid, opinions differ. Colin's

view—rather improbable—thinks it a post-mortem product of decomposition, and denies it any importance. Others consider it of great importance in the nutrition of the embryo. This opinion is defended by Bonnet, while Franck refers to the similar composition of the cotyledonous fluid and colostrum. According to Ercolani, the uterine milk is a product of the uterine glands; according to others, it follows fatty degeneration and loosening of the epithelium of the surface of the cotyledons. Many investigators have been unable to prove the existence of this fluid *intra vitam*, probably as it is immediately absorbed after being secreted. Post-mortem examination shows more or less quantities of uterine milk.

Franck states that possibly some cotyledonous fluid may still be formed when the placental circulation stops, viz., after death of the mother. At that moment no further absorption by the chorion villi can take place, and an accumulation of the uterine milk results.

The greatest mass of the foetal envelope is formed by the chorion. Also from a practical standpoint the chorion is of importance. Outside of its great importance as to nutrition of the foetus, an exact knowledge in regard to the expulsion of the afterbirth is necessary. It also plays an important role in dropsy of the foetal membranes.

#### AMNION, TUNICA OVI INTIMA.

The amnion is formed by the external layer of the blastoderm. Beginning at the navel, it surrounds the foetus like a sac, enclosing the latter entirely. This sac contains a fluid, the *liquor amnii*.

The amnion represents a thin membrane of little resistance. Its inner surface in ruminants shows numerous little yellow projecting spots, named by Claude Bernard, *plaques glycogénique*, as they are composed of glandular tissue capable of producing glycogen, thus replacing the function of the liver until the latter is completely developed (Joulin, St. Cyr and Violet, *Traité d'Obstétrique*). According to Lecoq, they are changed parts of the foetal skin, their histological structure

rather corroborating this view. In fact, microscopical examination reveals a close similarity with the skin. These plaques are most numerous about the amniotic portion of the umbilical cord.

The external surface of the amnion is partly in contact with the allantois, and laterally and at the back of the foetus with the face of the chorion. If distended, it is of oval shape, but depressed about the umbilicus, giving it a kidney or bean shape (F. Lecoq).

The liquor amnii during the first half of pregnancy in the bovine is a thin, amber-colored liquid of alkaline reaction, secreted by the internal face of the amnion. The quantity increases up to the middle of pregnancy, to decrease from then on. Its watery consistency up to the middle of pregnancy changes into a mucoid, opalescent, stringy mass.

Robin (St. Cyr and Violet) gives the following composition :

H <sub>2</sub> O.....	991-975 parts
Chlorides, Carbonates, Calcium, Kalium and Natrium	
Sulphates.....	2.60-7.80
Urea .....	2-3.50
Kreatin, Kreatinin, Sugar and Fat .....	traces of
Albumen and Mucin.....	0.82-10.70

The amount of liquor amnii at the time of birth amounts up to 4 kg. (Franck).

The liquor amnii often contains faeces of the foetus, meconium giving the liquid a brownish tinge. Kohler found in the liquor amnii of a cow, slaughtered on account of a calf too large to be delivered, 84 compressed hairballs of a grayish-white color.

Van Klaveren (Holland) reports that he removed an enormous calf (duration of pregnancy, 365 days). After embryotomy he irrigated the uterus, flushing out loose hair and nine hairballs of 5 to 6 cm. diameter. The second day after parturition he again found seven balls; the third day five balls and some more loose hair. In all probability this case is analogous with Kohler's.

The function of the liquor amnii is to protect the fœtus against external injuries; abnormal movements and mechanical influences are modified by it to such an extent as to protect the fœtus against violence. During parturition, on rupture of the foetal membrane, it lubricates the vagina and expedites the passage of the fœtus.

#### ALLANTOIS.

Between the chorion and amnion, as continuation of the urachus, lies a sac, which, on account of its sausage shape, is termed *allantois* ( $\alpha\lambda\lambda\alpha\zeta$ , sausage). The urachus forms the tube of communication between the allantois and the urinary bladder. The external face of the allantois rests against the internal face of the chorion. When the isolated and emptied sac of the allantois is inflated, a bicornual, irregularly cylindrical sac is formed. The head of the fœtus lies in the shortest but larger cornu; the longer cornu of less diameter forms that portion of the allantois where the posterior extremities are. (Lecoq.)

The allantoid sac contains: The allantoid liquid, the foetal urine, which increases toward the end of gestation. It is a whitish, foamy, thin liquid of neutral reaction. In the beginning of gestation it is colorless; later, yellow or brownish. Its quantity near pregnancy amounts to 8 to  $15\frac{1}{4}$  l.

Robin proved the absence of grape-sugar, oxalates, albumin, mucus and allantoidin in the allantoic liquid.

#### UMBILICAL VESICLE (*vesicula umbilicalis*).

The umbilical vessel is a provisory organ arising from the embryonic gut. It develops rapidly in the first days following conception in all mammalia, soon ceases to grow, and finally atrophies.

As soon as the allantois shows itself, it loses its importance as a nutritive organ of the fœtus, since the allantois carries the foetal vessels to the chorion, and now, by the formation of the placentæ, the fœtus is nourished from the mother.

The umbilical vesicle is a diverticulum of the intestines, situated externally to the abdominal cavity. These two communicate through the *ductus omphalentericus*. The umbilical vesicle of the bovine foetus is reduced to thread size in the sixth week. It is of no importance in obstetrics.

#### UMBILICAL CORD AND VAGINA UMBILICALIS.

The navel string (*funis*) is composed of the urachus, two umbilical arteries, two umbilical veins and the remains of the umbilical vesicle—the latter of no importance in advanced pregnancy. All these are imbedded in a gelatinous mass, the so-called "Gelatine of Wharton" (*Gelatina Whartoniana*). This substance is a mucoid tissue, its histological analogue being the vitreous humor of the eye. This mucoid tissue is difficult to separate from the umbilical cord. The umbilical cord's sheath (*vagina umbilicalis*) is a continuation of the amnion. At the continuation of the foetal integument a distinct line of demarcation is noticeable. The skin of the belly continues some centimetres beyond this sheath, this portion being known as skin-navel. The external face of the sheath shows epithelium and glycogenic plaques, its internal face being covered with endothelium.

The urachus begins at the fundus of the urinary bladder. It lies in Wharton's Gelatine, and loses itself in the allantois. It carries the urine of the bladder into the allantois and is still open at the time of birth.

The umbilical arteries (*arteria umbilicales*) spring from the internal iliac arteries. They pass along the bladder, help to form its round ligaments, embrace the urachus, pass through the skin-navel and reach the umbilical cord. Usually both umbilical arteries anastomose by transverse communication about the middle of the funis. They supply the amnion and ramify in the chorion. The smaller vessels go to the foetal placenta and ramify in the capillaries which lie in the villi of the foetal placenta below the epithelium. The umbilical veins (*venae umbilicales*) arise from the capillaries of the chorial villi, which empty at first into smaller, later

larger, branches. These run into two veins at the beginning of the umbilical cord, becoming confluent in the umbilical ring. The umbilical vein returns to the fœtus the blood aerated in the placenta; it has no valves. The blood vessels of the umbilical cord have a strong muscular wall, therefore contracting strongly when ruptured, as is the case at birth. The umbilical vessels of the calf are not all adhering to the umbilical ring, as is the case in other domestic animals. Only the vein is firmly attached. The umbilical arteries are united to the surroundings by loose connective tissue, and may be moved about in the umbilical ring. On tearing of the umbilical cord, they are severed within the abdominal cavity, or, rather, the peripheral end retracts within the abdominal cavity. (Franck.)

The flat, longish membrane (8 to 12 cm.) seen to hang from the navel of newly born calves, consists of the umbilical cord's sheath and umbilical veins. The knowledge of this condition is of the greatest moment in the aetiology of omphalitis.

In a calf of 30 kg., the length of the umbilical cord was 21 cm., the length of the calf 98 cm., and the weight of the placenta  $5\frac{1}{2}$  kg.

The umbilical vessels during the first half of gestation are stretched, while in the second half they are slightly twisted.

## 2.—The Age of the Fœtus.

The age of the fœtus is of importance for several reasons. It may be desirable to exactly define it at a forensic examination. Also, in premature birth (*partus præmaturus*) the knowledge of the various sizes of the fœtus as regards the period of gestation is of great importance.

Gurlt first gave definite rules enabling deductions as to the age of the fœtus. He divides pregnancy into seven unequal periods. Franck more practically describes the changes which take place each month in the fœtus. St. Cyr and Violet, by using the works of Chauveau and Arloing,

Colin, Goubeaux and Lanzilotti-Buonsanti, accept Franck's proposition.

We characterize the various periods of the bovine foetus as follows :

First month : The embryonic period, lasting 28 days. The foetus is 9 to 10 mm. long; the first signs of extremities appear.

Second month : This period extends from the 30th to the 60th day. The extremities develop. The pharyngeal cleft closes in the beginning of this month. The sternum still has a longitudinal fissure in the middle, closing toward the end of the eighth week. At the end of the second month one notices at the end of each extremity a little conical elevation, which is colorless and transparent. This is the first indication of the hoof. The length of the foetus is 48 mm. (Gurlt). In the ninth week its length is 8 cm. (Lanzilotti-Buonsanti).

Third month (60th to 90th day) : Toward the end of this month the four stomachs may be recognized (Gurlt). The foetus measures 14 cm. in length. The scrotum is present.

Fourth month (90th to 120th day) : In the beginning of the fourth month the hoofs become quite distinct; they are firm, non-transparent, and have a yellow color (Colin). The foetus is about 24 cm. long and weighs up to 2 kg. (Franck).

Fifth month (120th to 150th day) : In the beginning of the month the first tentaculæ (tactile hairs) appear on the lips, chin, upper eyelid, and orbital arch. The teats are plainly visible. The testicles descend into the scrotum. The foetus is about 35 cm. long and weighs  $2\frac{1}{2}$  to 3 kg.

Sixth month (150th to 180th day) : The eyelashes are more developed. The foetus is about 46 cm. long. The whole body is still naked excepting the lips and eyelids.

Seventh month (180th to 210th day) : At the end of this month a few long hairs appear at the end of the tail; also hairs about the coronet and on the spots where the horns appear. The foetus is about 60 cm. long.

Eighth month (210th to 240th day) : The back begins to be covered with hair, also along the edges of the ears. The

length of the fœtus toward the 32d week is 65 cm. (Gurlt), and toward the end of this month 75 cm. (Franck).

In the beginning of the ninth month the whole body is covered with hair and increases greatly in size. The fœtus measures from 80 to 100 cm. In the beginning of the tenth month the fœtus becomes mature.

### 3.—Nutrition of the Fœtus.

For the development of the ovum, nutritive elements are essential. When these are wanting, the egg perishes. Already in the ovary the ovum is nourished by the leucocytes; therefore it is reasonable to presume that nutrition after conception during the pre-placental period, takes place in this manner.

Uterine milk, essentially composed of leucocytes in various phases, may furnish the food. The cells of the ectoderm receive and prepare the nutriment. The material thus received first serves to enlarge the resorbing surface by multiplying the cells of the ectoderm, and only when this has progressed to a certain degree the embryo begins to develop (Bonnet).

In a later embryonic period the umbilical vesicle, with the omphalo-mesenteric vessels, forms. The embryo is nourished by the umbilical vesicle—that is, by the smaller branches of the omphalo-mesenteric vein (*Vena omphalo-mesenterica*). The heart then carries the nutritious elements to all parts of the embryo.

This early circulation, which might be called the omphalo-mesenteric circulation (*circulatio omphalo mesenterica*), exists, same as the umbilical vesicle, only for a time. When the latter disappears, and the allantois forms, it is replaced by the placental circulation, representing the foetal circulation (Fig. 10). By means of this circulation, the blood which circulated in the fœtus is taken to the fœtal placenta and reaches the smaller vessels of the chorion. Here its composition experiences changes and then returns to the fœtus. In the placenta an exchange of oxygen for carbon dioxide occurs, the circulation at this part fulfilling the same purpose

as the pulmonary circulation does in the lungs. The venous blood in the placenta gives off carbon and takes up oxygen. This process is the so-called placental respiration. The blood oxygenated in the placenta reaches the foetus at the umbilical

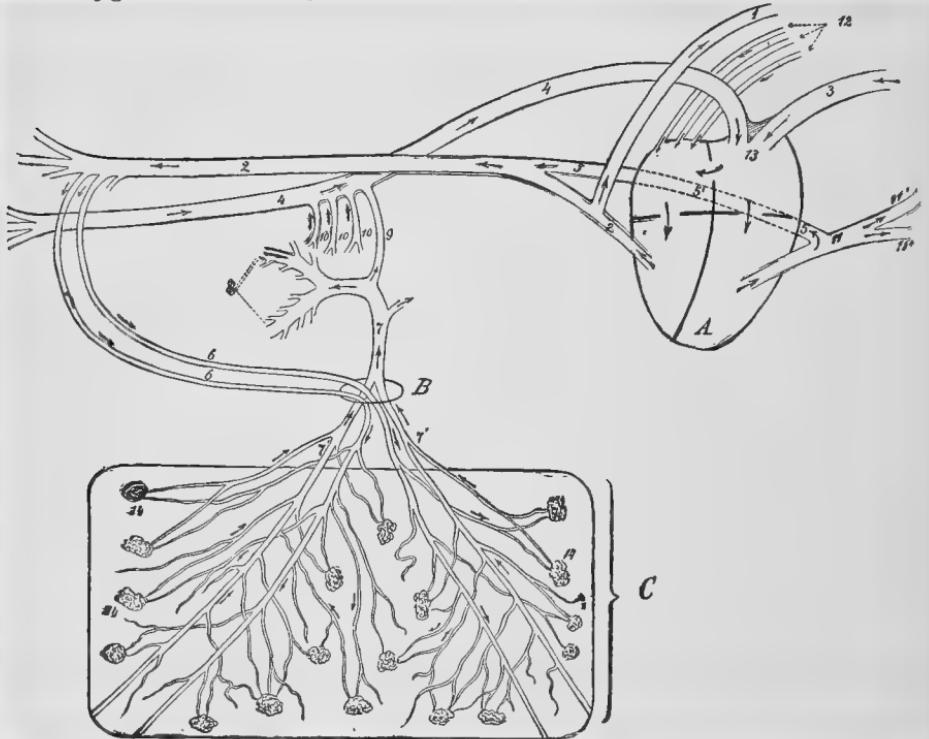


Fig. 10.—Schematic Sketch of the Foetal Circulation of a Calf.

The arrows indicate the direction in which the blood flows.

**A.** Heart; **B**, umbilical opening; **C**, portion of the chorion. 1, Anterior aorta; 2, posterior aorta; 3, anterior vena cava; 4, posterior vena cava; 5, duct of Botalli; 5', part of Botalli's duct posterior to the heart (sketched somewhat too long, but was necessary in order to demonstrate it); 6, umbilical arteries; 7, umbilical vein; 7', some of its branches; 8, portal vein; 9, ductus venosus; 10, portal veins; 11, pulmonary artery; 11', some of its branches; 12, pulmonary veins; 13, tuberculum Loweri; 14, chorion papillæ.

ring by the two umbilical veins. Within the umbilical ring the two veins coalesce to form one vessel, which leads to the liver (*porta hepatica*), first giving off a branch (*ductus Arantii*) emptying into the posterior vena cava. The remain-

ing trunk forms one vessel with the portal vein. At this spot, then, the first mixture of the arterial blood of the umbilical veins with the hepatic venous blood takes place. The trunk of the umbilical veins divides in the liver into numerous capillaries, from which finally the hepatic veins arise and empty into the posterior vena cava. The arterial blood of the umbilical veins, which, on account of its mixing with the vena portæ, has been modified in its composition, now undergoes a second mixing, namely, with the blood of the posterior vena cava.

Only a part of the blood of the umbilical veins circulates through the liver, while another part, as already related, empties into the posterior vena cava, via the ductus Arantii. Hepatic veins and ductus Arantii finally carry the umbilical veins' blood into the posterior vena cava, and the latter takes it to the left auricle of the heart. When the blood arrives in the right auricle, it runs through the oval foramen (situated in the septum between right and left auricle) into the left auricle, the blood current being guided by an eminence, the *tuberculum Loweri*.

During foetal life an oval orifice (*foramen ovale*) is found replaced in the adult by the fossa ovalis. It has a diameter of 1 cm., has an infundibuliform opening into the right auricle, and guides the blood carried by the posterior vena cava directly into the left auricle. On that side of the septum turned toward the left auricle lies the funnel-shaped valve of the oval foramen (*valvula foraminis ovalis*), formed by a fold of the endocardium. It is attached to the edge of the oval foramen, and its perforated infundibulum projects into the left auricle. This valve prevents a return flow of the blood from the left into the right auricle. In the left auricle the blood coming from the right auricle mixes with the venous blood of the pulmonary veins. This mixture is of little moment, as the amount of blood flowing through the lungs during intrauterine life is a small quantity. From the left auricle the foetal blood goes through the auriculo-ventricular opening into the left auricle and on through the aorta to

the various portions of the body. Blood mixtures take place at the following places:

1. At the portal fissure, a confluence of the *vena portæ* and arterial blood of the umbilical veins.
2. At the end of the *ductus Arantii*, into the posterior *vena cava*, and at the end of the hepatic veins, also into the last named.
3. In the left auricle, a mixing of the pulmonary blood, carried by the posterior *vena cava* from the right to the left auricle. The blood of the anterior aorta supplying the anterior extremity experiences now no further change. After coursing through the capillaries into the veins, it returns through the anterior *vena cava* to the right auricle. From here it gains the right ventricle and pulmonary artery. But the greater part flows through *Botalli's duct* (*ductus Botalli*) into the posterior aorta.

The *ductus Botalli* is a short tube running obliquely from left to right and before to behind, and connects the pulmonary artery with the posterior aorta. A very small amount of the blood reaches the lungs via the pulmonary artery (*arteria pulmonaris*), and from here, after circulating through the capillaries, arrives in the left auricle by the left auricle.

The placenta is the organ of respiration. What the lungs are to the breathing animal the placenta is to the foetus. In the placenta, more than a simple exchange of carbon for oxygen takes place. In all probability, nutritive elements pass the placental filter, although apparently during this process a modification in the composition occurs. Between the villi of the foetal and maternal placenta a thin layer of uterine milk is found. One is of the opinion that nutritive elements from the capillaries of the uterine mucosa carried into the epithelium of the maternal placenta are there changed into uterine milk. Bonnet proved that the fat of the uterine milk is no product of degeneration, but the result of infiltration.

The uterine milk, or certain of its constituents, under the influence of pressure, are supposed to enter the epithelia of

the villi of the chorion, and reach here the blood current of the foetus. According to this hypothesis, uterine milk plays as important a role in the later foetal periods as at the time when the various organs first begin to develop.

Experiments show that under high pressure white blood cells, pigment and bacilli pass the placental filter; under ordinary conditions, with moderate pressure, this does not occur readily. The bacillus of glanders, tuberculosis, pass through that filter, but the anthrax bacillus does not invariably.

That tubercule bacilli penetrate the placental foetus, the various cases of tuberculosis of the bovine foetus reported in our literature prove (Bang, Johne, Korevaar, Lungwitz). In the case reported by Korevaar, no tuberculosis of the uterus was present.

#### ANATOMICAL DEVIATIONS OF THE FŒTUS.

The digestive apparatus of the bovine foetus shows some modifications of general interest.

The abomasum is well developed, and forms the greater part of the four receptacles. The rumen is small. The intestinal canal is rather short, and contains yellowish or greenish fatty faeces, termed meconium, small pieces of which are occasionally found in the amniotic fluid. The liver in the foetus is greatly developed and by far the largest organ.

After birth the abomasum and liver decrease in size; that is, their volume does not decrease, but their slow growth and the rapid development of the others equalizes matters soon.

#### THE RESPIRATORY APPARATUS.

The lungs of the foetus are in the state of atelectasis, that is, they are devoid of air and their vascular supply is limited. In the anterior mediastinum of the foetus between the two layers lies a glandular organ, the sweetbread, or thymus (*glandula thymus*). It is already present at the second month

of intra-uterine life, increasing up to birth, and then diminishes in size. At birth the thymus of the calf weighs 100 to 200 g.

According to Ellenberger's "Anatomy," the atrophy of the thymus is the result of fatty degeneration, gradually extending from the surface to the interior, crowding upon the follicles and causing atrophy.

The thymus has a histological structure simulating lymph glands, and is counted among the blood glands.

#### THE GENITO-URINARY APPARATUS.

The kidneys of the foetus are large and lobulated. The Wolffian bodies, or primordial kidneys, have disappeared at birth. The urinary bladder, by means of the urachus, is in direct communication with the allantois. At birth, the umbilical cord tears, as also the urachus. The muscular layer of the bladder contracts, thus obliterating the entrance into the urachus. The testicles at the time of birth are already in the scrotum.

#### 4.—The Intra-Uterine Position of the Foetus.

In the beginning of pregnancy the foetus floats in the amniotic liquid, and therefore does not occupy a distinct position. Later, toward the end of gestation, its position is more stationary, because the walls of the uterus apply themselves to the foetus. When only one calf is present, it rests in one of the uterine horns; when twins, usually each cornu harbors one calf. Should both calves arise from the same ovum, a common chorion but individual allantois and amnion are found. In this case each foetus has its own circulation. Observations show that under such conditions both foetuses have the same sex. When the foetuses develop from several eggs, each has its own chorion, and they are mostly of different sex.

Franck was of the opinion that the foetus has a defined position at the outset of pregnancy. In numerous post mortem examinations by him of the pregnant uteri of sheep

and cows, he always found the foetus' back turned toward the convexity of the horn and the belly toward the concavity. According to Franck, temporary deviations in the foetal position may occur, but it always returns to its original normal position. The calf lies laterally in the right abdomen, with its head turned toward the pelvic outlet in such a manner that the oblique long axis of the young meets the oblique long axis of the mother at an angle of 30 deg.

The back forms an arch, the limbs rest against each other, the forelegs are flexed at the knees and the hindlegs point forward. The head is bent toward the sternum.

Franck, on the strength of his experiments (i.e. 110), thinks that the weight of the vertebral column and the excessive development of the liver induced that position where the back was concave.

It also happens that the posterior extremities of the young are turned toward the pelvic inlet of the mother; this is the so-called croup or breech presentation. In the cow 4 to 5 per cent. of posterior presentations occur (Kehrer).

### 5.—Multiple Pregnancy.

The cow, as a rule, is uniparous—that is, produces one young at a birth, although twins are not uncommon. Collin (de Wassy) reports a cow which was served twice and brought forth three calves, two females and one male, the total weight of which was 64 kg.

Rainard mentions two cases of quadruples.

Lessona published a case where an 18 year old cow bore five calves, three females and two males. They only lived eight days.

Van Klaveren (Holland) reports the following case: A four-year-old cow gave birth thirty to thirty-two days before her regular time. The animal previously was perfectly well, and thirteen days before delivery jumped a wide ditch. She expelled at that time two foetuses, one immediately after the other; an hour later three more followed. After parturition,

severe uterine contractions set in, which induced the worried owner to apply a bandage to prevent an eventual prolapsus. Since the contractions increased in severity, the bandage was removed and the uterus examined, and a sixth foetus was detected, which was born easily. The afterbirth came away in proper time. There were two pairs of envelopes, so that three foetuses had one common chorion. The foetuses were well developed for their age. Three had red, one black and the others fawn color; four were males, two females; two foetuses weighed each 10 kg., one 11 kg., two each 12 kg., and one 14 kg. The six calves had a total weight of 69 kg. This fertile female made a good recovery and remained in good health ever since.

A case of multiple pregnancy is mentioned by Fleming, who quotes from MacGillavry. A small polled cow gave birth to one calf in 1842, seven in 1843, two in 1844, three in 1845, six in 1846, two in 1847, and four in 1848,—altogether twenty-five calves in seven years.

Koch observed seven young in a cow.

Kleinschmidt reports that a cow which delivered one strong calf was slaughtered on account of a serious disease. In the uterus and vagina were found fifteen calves.

In twins, as a rule, each foetus occupies one uterine horn. Both usually have a normal position, one the anterior and the other the posterior presentation. Harms mentions one case where the two foetuses rested in one horn and the uterus. The pregnant horn in this case had increased to such an extent that the second foetus could not be felt after the first one developed.

Numan noticed that in the bovines the foetuses of multiple pregnancy, when of opposite sex, the females, as a rule, are sterile, and are known as free martins. This observation has been corroborated by many, as Villeroy, Gurlt, Sanson and others. They also hold that the same rule holds true with the mare, and only the sheep forms an exception to this rule (St. Cyr and Violet).

The above shows that multiple pregnancy in bovines

occurs quite often. Many practitioners therefore always examine the uterus after delivery to see whether another calf is present. This custom is good and ought to be cultivated by the young practitioner. At the same time the uterine contractions of a uterus disturbed by multiple pregnancy are weak and short, so that often quite some time passes before the envelopes reach the vaginal passage. Owners often try to subdue strong pains, fearing a prolapsus, while just these contractions are concerned in the expulsion of the unexpected foetus.

## 6.—Diagnosis and Differential Diagnosis of Pregnancy

By pregnancy, that state of a female is understood when the foetus develops; from a eutokological point of view it is also the development of the foetus in the uterus—*gravititas uterina*. This differentiation is made, as also a pregnancy exists, where the foetus does not develop in the uterus itself, but externally to it, which shall be discussed later on.

In the previous paragraphs, changes of the position of the gravid uterus have already been dealt with. We further know that in the uterus and surroundings various changes take place.

The nutrition of the foetus deprives the tissues of the mother of constituents which must be replaced, besides that gestation considerably modifies the circulation. All this gives rise to certain symptoms which lead us to think that the animal is pregnant. In a later period, when the foetus moves, other symptoms manifest themselves, induced directly by the foetus. These especially simplify the diagnosis of pregnancy. After conception, respectively fecundation of the ovum, the visible changes in the pregnant animal are very limited; even after some weeks little is noticeable. One of the first symptoms suggestive of pregnancy is caused by the fact that no more eggs leave the ovaries periodically, and that the symptoms accompanying the process—rutting—do not become

manifest; oestrus in the cow repeats itself every three to four weeks. Should oestrus not set in, conception is surmised.

In many cases this holds true, although some cows rut quietly and are overlooked. Besides, it happens at times that pregnant cows bull three or four weeks after fecundation, take the male, and the cow as a consequence is three or four weeks too early, or, rather, the attendant overlooks the fact that she conceived at the first coition.

During the first months of pregnancy the behavior of the cow changes some; she avoids galloping, jumping ditches and fighting with other cows. Some observers noticed that certain cows develop peculiar notions, viz., eat dirt, gnaw stones, drink a great deal of water, etc. Some cows when pregnant become fat. This symptom is often quite a positive one to the owner or attendant.

An increase in the quantity of blood takes place in the second half of gestation as a consequence of the increased placental circulation. As a further consequence, the heart undergoes greater efforts to supply the parts with blood, the heart becomes larger, active dilatation—hypertrophy—takes place. This hypertrophy of the heart does not disappear soon after parturition, but continues for quite a while, to become permanent if immediate fecundation occurs. Therefore, hypertrophy of the heart is frequently seen in old cows who calved yearly.

It is well known that the horns grow less during pregnancy than otherwise. This alternating increase and decrease in the production of horn is recognized by ring formation of the horns. The number of rings, therefore, give an approximate idea how many periods of pregnancy or how many calves the cow had. An unusually large space between two rings indicates that the periodical yearly pregnancy was missed. Of course one must remember that an alternating rich and poor diet, when extending over a period of about six months, influences the growth of horn similarly.

The changed position of the gravid uterus causes a dilatation of the right lower region of the belly; it becomes

asymmetric. This asymmetry is also seen in some diseases, and will be discussed in the differential diagnosis. Toward the end of gestation, when the pregnant uterus occupies a great portion of the abdominal cavity, the right lower abdominal region bulges out materially, the flanks fall in, and the contour of the last ribs, transverse processes of the lumbar vertebrae and sacrum become plainly visible. As a result of the expansion of the belly, the diaphragm is crowded upon during inspiration and costal respiration the result, and the thorax expands more while the abdominal muscles participate less in respiration. This is plainly visible in old cows; they turn the elbows outward to get the assistance during respiration of certain muscles common to the anterior limbs.

Although the increased size of the belly makes pregnancy a reasonable, it is nevertheless not a positive indication; therefore, mensuration of the circumference of the belly is of no value.

The cow during the period of gestation yields a considerable amount of milk. On the one hand, more food is taken in to nourish and develop the foetus; on the other, many constituents leave the body in the form of milk. The milch cow has been bred for generations with a view to produce a great milker, and has about reached in that respect the physiological limit. There exists, as Stockfleth put it rightly, a competition between the uterus and udder. Stockfleth deducts from this that when the latter is victorious the former succumbs and abortion takes place. He believes, therefore, that this physiological relationship ought to be looked upon as a predisposing factor in the frequently occurring abortion of the cow.

In the milk cow, the udder at times swells several weeks before the calf is born. After birth milk secretion rises to a certain degree, remains constant, and decreases about two or three months before the end of pregnancy. The time between cessation of lactation and birth is the period of dryness. Its duration may be very variable. Some owners do not wait for the time when the milk secretion stops, but discontinue milking sooner and dry the animal off. They insist that in this

way the feeding of the milch cow is made easier, and expenses diminished, as they do not have to milk her. At this period the calf develops most. In most cases the animal goes dry two to three months, while in persistent milkers the period of dryness is only four weeks. There are also cases where the animal milks from calf to calf.

Shortly before birth, often only in the preparatory stage, the so-called springing of the udder takes place. With primiparae, the udder begins to develop two or three months before the end of gestation. When this occurs in the two or three year old heifer, with no further rutting after coition, one may be reasonably certain of pregnancy. In the udder of the primipara one finds, during the second half of gestation, a yellowish, viscid, glutinous liquid. Many dealers look upon it as a criterion of pregnancy when obtaining such a liquid from a heifer. Nevertheless, it is not a positive sign. I have observed several times that virgin heifers when suckled by calves give milk; but the secretion in these instances is not yellow and sticky, but white and milky.

About four to six weeks before the termination of pregnancy, according to Franck, the urine of many cows contains albumen, which disappears a few days after birth. Albrecht's investigations are negative in this respect. I have never found albumen in urine of pregnant cows.

#### EXAMINATION FOR PREGNANCY.

The presence of pregnancy in the cow is established by considering and combining the previously mentioned phenomena. A positive diagnosis as to pregnancy can only be made by appreciating symptoms induced by the foetus, or by local examination. This examination may be an external or internal one.

The external examination comprises palpation of the abdomen, foetal movements, examination of the udder and obstetric auscultation.

By palpation we intend to establish the presence of the foetus in the right lower abdominal region. For this purpose,

one stands on the right side of the cow, turning the face in that direction. Now the closed fist is placed upon the belly in front of the stifle, and executes short inward movements. While thus pushing cautiously at intervals one feels plainly the resistance of a hard body (provided a foetus is within), and how it returns to its original position after having been displaced by the pushing movements of the fist. In the beginning of gestation palpation of the abdomen yields no results, but in the second half, especially at the fifth or sixth month, when the foetal movements are weak, it is a pretty good means of diagnosis. This manipulation, also known as the palpation of the calf, is employed by many breeders.

The perception of foetal movements is the best diagnostic proof, but they are only palpable in the second half of pregnancy. Of course muscular movements of the foetus occur already at the third month, but are too weak to be felt through the abdominal wall. About the fifth, or more plainly at the sixth month and later, can we perceive these foetal movements in the cow.

For this purpose one occupies the right side of the cow, turning the face towards the hindquarters, places the right hand upon the back of the animal, the palm and surface of the left hand being placed against the abdomen in front of the stifle. For this examination much patience is required, as quite some time may pass before foetal movements are appreciated. In the sixth and seventh month the movements are more wave-like and weaker than later, when they are shorter but stronger and of a kicking nature. Mistaking it for peristalsis is hardly possible after some practice. Toward the end of gestation, palpation in lean cows often reveals which part of the calf is presented.

According to some investigators, movements cannot be produced by pushing against the abdominal wall. Experience at the same time teaches that slight shocks and displacement of the foetus encourages foetal movements. It may be said that the displacement of the foetus permits of a temporary torsion of the umbilical cord on its long axis; as a conse-

quence, the blood vessels are compressed, which induces circulatory disturbances, and this gives rise to foetal movements.

We know that accumulation of carbon dioxide and want of oxygen in the placental blood, as also arterial anaemia of the uterus, are capable of bringing about foetal movements. In practice, one makes use of it by allowing the cow a draught of cold water while examining her. As a result of the entrance of a greater amount of cold water, a contraction of the smaller arteries and a decreased blood supply to the uterus is produced. Severe exertion, as running in the pasture, increases the consumption of oxygen, and thus stronger foetal movements may result.

#### EXAMINATION OF THE UDDER.

In primiparae the presence of a sticky, yellowish, viscid liquid in the udder makes pregnancy a decided probability. The swelling of the udder a few weeks before the expiration of her term, points toward pregnancy; besides that, a number of phenomena permit an earlier diagnosis.

#### OBSTETRICAL AUSCULTATION.

By it we understand the detection of the foetal heart sounds. Mayer of Genf (1818) was the first who observed in man the foetal heart-beat on auscultation of the abdomen. Kergaradec (1822) differentiates between two important phenomena on auscultation, viz., heart sounds of the foetus and uterine sounds. In man, obstetrical auscultation is a valuable auxiliary means for the diagnosis; the life and presence of the foetus can thus be established with a great deal of certainty. In cows, many tests have been made to define whether auscultation of the heart sounds is a practical measure to recognize pregnancy. Lafosse of Toulouse was the first to communicate in 1857, to have learned the heart-beats of the foetus on examining numerous pregnant cows; it being especially marked at the sixth month. In 1857 Hollman published that he also observed them. Saake in 1869 contributed the details of investigations along that line. He used the stetho-

scope, and names as the place for this indirect auscultation the right iliac region (*regio iliaca dextra*), close in front and a little to one side of the crural arch (*arcus cruralis*). This observation is arranged as follows:

No.	Number of Heart Sounds		Duration of Pregnancy
	Mother	Fœtus	
1	68	146	178 Days (25 Weeks)
2	84	158	207 , (29 ,
3	73	162	221 , (31 ,
4	72	128	244 , (35 ,
5	84	150	36 Weeks
6	74	128	Last Quarter
7	72	160	,
8	?	168	2 hours before birth

Saake mentions a case where fracture of the ischium was complicated with torsion of the uterus, and where the gravid uterus was felt in the left lower abdominal region on auscultation of that part, faint foetal heart sounds could be detected.

St. Cyr and Violet heard in two-thirds of all cases examined by them foetal heart-beats. They mention also to have imagined hearing the foetal heart one day, not to have detected it the following day, while some days later again the sound became quite perceptive. Eighteen cows closely examined by them showed a minimum of 96 and a maximum of 154 heart sounds. In one fœtus fluctuations from 116 to 140 were observed.

Harms says, in reference to the examinations of Saake: "I have practiced these examinations repeatedly, but never with positive results."

According to my experience, the heart-beats of the fœtus may be heard now and then in the right abdominal region on auscultation; nevertheless, in numerous cases with well marked foetal movements on palpation, auscultation remained

negative. In veterinary practice there are better anchor sheets to recognize pregnancy than auscultation.

#### INTERNAL EXAMINATION FOR PREGNANCY.

To prove pregnancy beyond a doubt, the internal examination is preferable. By doing so the foetus is felt, thus establishing its presence beyond a doubt. Should the examination be negative, in the fourth or fifth month of the period of gestation, we cannot conclude that the animal is not pregnant. A four or five month old foetus in very long cows, or those with pendulous abdomen, cannot be reached. In other cases again, a four month old foetus can be plainly perceived by internal examination.

The internal examination can be executed in two ways: per vaginam and per rectum. The examination per vaginam with cows takes place as follows: On examination with the right hand, an assistant pulls the tail to the right. The examiner stands behind the cow a little toward the left. The hand, the nails of which have been trimmed closely, is rubbed with pure oil. In between times the assistant washes with soap and water the tail and vulva, to prevent, on exploration of the vagina, the introduction of faeces, which often adhere to the outer surface of the labia. The hand is shaped like a cone, and slowly, under rotary movements, enters through the vulva into the vestibule. By advancing further, the tips of the fingers touch the vaginal portion of the uterus.

In the pregnant state the cervix is tightly shut and the os uteri covered with tenacious mucus (the secretion of the mucous folds, *palma plicata*). In the unimpregnated state the cervical canal is also closed, but the mucus layer is less adherent and solid. The beginner will find it advisable to acquaint himself with the conditions of the vaginal portion of the uterus by exploring unimpregnated animals. The calf can be felt by vaginal exploration of the pregnant female; but one must remember that this is often only possible in well advanced gestation. For this reason rectal examination deserves the preference.

Although one need not fear premature birth (*partus præmaturus*) as a result of careful and not too frequently repeated vaginal exploration, rectal examination is of more use. This method gives the best results, and is accompanied with little danger. It is employed when external examination leaves doubt as to whether pregnancy is present or not. Its execution is as follows: An assistant holds the head of the cow by means of a halter, standing on the left side of the animal. Another person pulls the tail to the right. The operator, after oiling the right hand and arm, enters the rectum similarly as described for the vaginal examination. The fæces are best removed. Now the hand and arm are cleansed and again introduced into the rectum. Whenever the arm enters up to about one half the length of the radius, it is well to locate, at the upper wall of the rectum, the promontory. This is easily found. Following from here to the right and left the linea innominata, the entrance of the pelvis is palpated. Below, at the outer border of the pelvis, one finds a sausage-shaped mass, the neck of the uterus (*cervix uteri*). The volar surface of the hand, when advanced in a downward direction from this point, detects a more or less extensive object, provided a foetus is present, conveying the impression as if swimming in the abdominal cavity. When pressed upon by the hand, it slips away, to immediately return to its original position. Closer examination reveals the head and other parts of the foetal body.

From the fifth month on, rectal examination establishes pregnancy with certainty. This is also possible before that time in many cases, but a negative exploration does not necessarily imply that the animal is not pregnant. It has happened to experienced practitioners to declare a female without calf, while later distinct symptoms of pregnancy manifested themselves, the date of the birth showing that the animal at the time of the examination had passed one-half of the period of gestation. Broholm states that with some practice a seven to eight weeks old foetus can be detected. One should endeavor to obtain sufficient dexterity on rectal

examination to (1) find the empty uterus; (2) recognize the changes of the gravid uterus; and (3) to search for the foetus.

Toward the end of pregnancy the diagnosis is easy. At the seventh or eighth month the position of the calf can be established per rectum. At that time a rectal examination is usually unnecessary, as foetal movements detected by external palpation suffice. In law questions, the examination must be complete, and the rectal examination cannot be omitted.

It is very difficult to diagnose twins in the cow. Simply a great circumference of the belly during pregnancy is no criterion of twins, as many causes, such as dropsy of the foetal membranes, or an excessively large calf, etc., may be the cause of it.

Whenever we feel a calf and foetal movements on the right as well as left abdominal walls of the cow, one may be reasonably certain of twins.

In these cases rectal examination is of no great value, although it may be in other cases. As to the diagnosis of a dead foetus, see "Premature Birth" (*partus præmaturus*).

#### DIFFERENTIAL DIAGNOSIS OF PREGNANCY.

In the diagnosis of pregnancy it is desirable to be acquainted with those morbid conditions simulating gestation. There are many abnormalities in the cow inducing the owner to believe that the animal is pregnant. As a close observer, he may notice certain phenomena which cause him to think that the course is abnormal, for which reason he consults the veterinarian.

One of the diseases in the cow resembling pregnancy is dropsy of the belly,—ascites. In these patients the rectal examination is decisive. By pushing with the cone-shaped hand against the right abdominal wall, the fluctuations of the transudation can often be heard; but in cows suffering with chronic intestinal catarrh, the liquid intestinal contents may produce a similar noise (Harms). Very large tumors may lead to mistakes in the diagnosis of pregnancy. Harms met with an ovarian tumor in the cow weighing 13 kg. (26 lbs.)

This tumor could be felt on internal and external exploration. Bruckmüller mentions in his pathological zootomy that Wolff found a fibrous polypus in the uterus of a cow weighing 200 lbs. Kehm found in the uterus of a cow supposed to be pregnant an atheromatous cyst (steatoma) of 50 lbs.

At times one finds leiomyoma of great circumference. Also, a diffuse, sarcomatous infiltration of the uterine walls may result in an enormous increase of size; also tuberculosis of the uterus, if it attacks the serous membrane by continuity (Oster-tag). All layers of the wall are then infiltrated and enormously thickened. Echinococcosis of the liver may enlarge the liver to such an extent that it expands the abdomen sufficiently to simulate pregnancy (Harms). Palpation of the right abdominal region behind the last rib, as well as rectal examination, with consideration of the other phenomena, are sufficient to avoid an error.

*Obesity.*—Very fat cows with great abdominal circumference, the result of an undue accumulation of adipose tissue, may be thought to be pregnant, especially as the udder also becomes enlarged. A simple examination will allow us to make a correct diagnosis.

All these abnormalities resemble pregnancy. A close examination can prove the absence of pregnancy, while doubts often prevail as to the exact nature of the abnormality.

### 7.—Duration of Pregnancy.

The time elapsing between conception and expulsion of the foetus, and during which the calf is fully developed in the cow, is about nine months, or thirty-nine to forty weeks. The shortest period of gestation, according to Dietrichs, is 210 days, the longest 335, the average 286 days (Franck).

Baumeister and Rueff put the average period of pregnancy at 285 days, the shortest 240, the longest 330 days.

The cows of the "Rijks Veeart-senijsschool" at Utrecht average 40 weeks, heifers one or two days less. Many factors may influence this period. We know that primiparæ carry

the calf usually 39 weeks ; that is a few days less. Even here one finds many exceptions. Generally, one imagines that the mother carries a male foetus a little longer than a female one. Also, the age of the mother, heredity and breed may influence the length of the period of gestation.

Literature gives several cases of abnormal pregnancy. Servatius reports that a cow was pregnant for 391 days, another 371, a third 400, and a fourth 376 days. Clark mentions a case where the period of pregnancy of a cow was 365 days, and where a living calf of extraordinary size was born. Precocity also seems to have some influence. The period of pregnancy in highly bred and early maturing breeds is shorter (Wilhelm).

### 8.—The Influence of Pregnancy on Some Diseases.

It is well known that pregnancy changes the course of some diseases ; still, we do not know much about this. In man, this point is much more important, and its knowledge is a great factor to the diagnostician.

Many diseases run the same course whether an animal is pregnant or not. Foot and mouth disease seems to have just as little influence upon pregnancy as it has upon the disease. But experience teaches that pregnant cows, when suffering with anaemia or hydræmia, sooner succumb than in the unimpregnated state. The morbid process is increased, as many constituents, otherwise retained by the mother, are utilized to nourish the foetus.

Experience in numerous cases shows that cows with certain symptoms leading with probability to a diagnosis of tuberculosis, look better while pregnant, and apparently gain flesh. After birth tuberculosis advanced with gigantic strides, thus permitting it to appear as if tuberculosis during gestation was latent.

When osteomalacia occurs in the pregnant female, its course is quicker and more serious than in the virgin state. It is an old fact, that pregnancy and lactation hasten the

development of this disease. Should lactation cease before the end of pregnancy, the patient improves; while six to eight weeks after birth the disease becomes extensive (Friedberger and Fröhner).

Calves borne by cows suffering with osteomalacia are often in good condition, making it appear that lime salts for the formation of the osseous frame of the foetus were furnished at the expense of the mother.

Cows in the second half of pregnancy often suffer with indigestion; it being rare when they are fed properly. In certain localities, however, where for economical reasons a voluminous diet, often difficult of digestion, is furnished, digestive disturbances in the pregnant animal result.

### 9.—Superfecundation and Superfoetation.

By superfecundation is understood the fertilization of two or more eggs of one oestrus at short intervals; this making it possible that one ovum is fecundated by one bull and the other ovum by another bull. At birth the mother bears two young created by different males. In the cow this is exceedingly rare.

By superfoetation we understand conception during pregnancy. This has been seen occasionally in the cow. As a rule, the second conception induces abortion of the first foetus; but it happens that one calf is carried the full term, and the other is aborted, that both calves are retained or both foetuses are aborted.

## B.—NORMAL BIRTH—EUTOKIA.

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### I.

#### THE GENITAL PASSAGE.

##### 1.—Pelvic Canal.

The two halves of the pelvis enclose a space, designated the *pelvic canal*, serving the foetus as a passage-way. This canal has an inlet, an outlet, a superior, an inferior and two lateral planes.

The inlet is formed by the sacrum, its two wings, the internal faces of the iliac and the anterior border of the pelvic bones. This anterior opening is shaped like an ellipse, its greatest diameter lying under an angle of  $45^{\circ}$ , and is in proportion to the smaller horizontal diameter as 4:3. The ellipse is flattened laterally.

The outlet is formed by the last sacral vertebra and first three coccygeal vertebrae, posterior ligaments and the ischial arch. It is of circular shape; its plane, although smaller than that on the inlet, is capable of expansion.

The superior plane or roof of the pelvic canal is not horizontal, but quite strongly concave, as the result of the concave inferior face of the sacrum; therefore the anterior portion of the roof, beginning at the promontory (articular head of the first sacral vertebra), runs backward and upward. The most posterior portion of the superior plane is formed by the bodies of the third and fourth coccygeal vertebrae; consequently, the vertical diameter of the outlet varies. The inferior plane or floor of the pelvic canal is concave; the anterior part, the anterior border of the pelvis, lies about 4 to 5 cm. below the posterior end of the symphysis. The line connecting these two points runs from before to behind, at first downward and finally upward, forming with a hori-

zontal plane an angle of  $45^{\circ}$ . The pelvis, therefore, lies much higher posteriorly than anteriorly. The lateral planes are formed by the internal surface of the sacro-sciatic ligaments, the internal face of the internal angles of the iliac, the internal face of branches of the pubes and ischia. A part of the latter also forms the floor.

The lateral planes being partly formed by bones and partly by the pelvic ligaments, they can only expand superiorly. From an obstetrical point of view, the pelvic inlet is of the greatest importance, as the position during labor of the calf must accommodate itself to the shape of this inlet by rotating around its long axis.

The connection between the ossa innominata and the vertebral column takes place by means of the sacro-iliac articulation. It is formed by the wings of the sacrum and the internal face of the ilium. The joint permits of but limited movement; only during the latter stage of pregnancy, when the pelvic ligaments infiltrate and thus become more elastic, can we speak of any movement (Franck). From an obstetrical standpoint, this joint is very important. In such labor cases where a great deal of power is employed to extract the calf, an injury to this joint is often the cause of post-partum paralysis. The wide pelvic ligaments also unite the sacrum and the coxae. The union of the innominate bones takes place at the pelvic symphysis (*syphysis pelvis*). The union is formed by cartilage, strengthened superiorly and inferiorly by short connective tissue and elastic fibres, the lig. arcuatum, which runs obliquely across from one pubis to the ischium, uniting with the cartilage and periosteum. In young animals this union is rather elastic and some little expansions possible, but not after the second year. In older animals this symphysis ossifies completely, and the middle portion of the pubis and ischium, especially round the oval foramen, becomes thinner.

#### PELVIC DIMENSIONS.

Pelvic diameters of the domestic animal, especially the horse and cow, have been established same as in man; provided

these data rest upon an anatomical basis, that is, fixed points of the pelvic canal, they are of some value. Many diameters, considered from a practical standpoint, are of little importance; the relative dimensions of some may be of theoretical and practical value. As already mentioned, the inlet of the pelvic canal has the shape of an ellipse, lying under an angle of 45°.

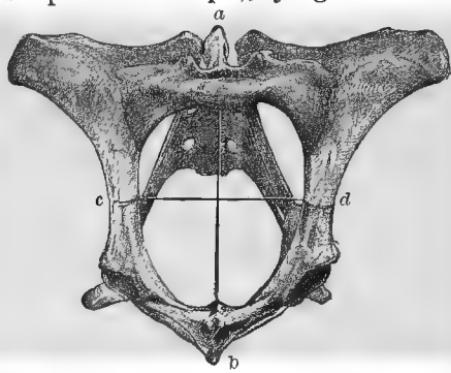
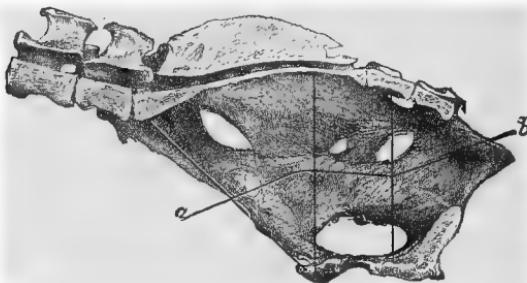


Fig. 11.

*a*—*b*, Vertical diameter of pelvic inlet. *c*—*d*, Greatest transverse diameter of pelvic inlet.

Fig. 12.—Section of pelvis with guiding line *a*-*b*.

The long diameter of this ellipse runs from the promontory to the symphysis pubis; the short one indicates the greatest width of the pelvic inlet, and runs between the ileo-pectineal crests.

Franck terms the long diameter *conjugata vera*. This name may be continued in considering the fact that it thus designates this diameter in the human pelvis, although in the

latter the conjugata represents the short diameter of the pelvic inlet. The greatest width of the pelvis is called by Franck the middle transverse diameter, or *distantia psoadica*, Franck recognizing besides an inferior transverse diameter extending between the pectineal tubercles. This diameter is about 2 cm. shorter than the greatest width of the pelvis.

The height of the pelvic inlet (anterior vertical diameter of Franck, diameter sacro-pubien of St. Cyr and Violet) is formed by a line resting vertically upon the anterior extremity of the ischio-pubic symphysis. This line in the cow touches the body of the third sacral vertebra (Fig. 11). On account of the concavity of the inferior face of the sacrum, this diameter is of considerable size in bovines. In the same manner as in the inlet, we distinguish length and width of the pelvic passage. The first or vertical diameter of this passage rests vertically upon the deepest point of the symphysis, and touches the body of the second coccygeal vertebra. The width represents the distance between the cotyloid cavities (the middle transverse diameter of Franck). It is of little value to define the diameters of the outlet on account of its expansibility; only the distance between the postero-external angles of the ischium are unchangeable.

The pelvic axis, also termed line of guidance, is a line which the long axis of the foetus follows during parturition (Fig. 12). This line is very important, as its course indicates in which direction traction should assist the expulsive force. This line is obtained by uniting the centres of all lines vertical to the symphysis and which come in contact with the inferior surface of the sacrum and the first coccygeal vertebra. This line runs obliquely upwards at the inlet, descends a little to about one-half of the symphysis, and now ascends toward the outlet, forming with a horizontal pelvic plane an angle of 45°.

#### ESTIMATION OF PELVIC DIMENSIONS—PELVIMETRY.

Pelvic dimensions during life can be ascertained with a great deal of accuracy. There are two methods: one by C.

Harms, estimating the size of the diameter of exploration; the other by Arloing, who bases his calculations of the internal pelvic dimensions on the distances between certain external parts of the body.

DIMENSIONS OF THE PELVIC INLET OF SOME COWS, EXPRESSED IN  
CENTIMETERS.

Number	1	2	3	4	5	6	7	8	9	10
Distance between promontory and pubic crest.....	24.5	23.5	23	24	24	23	23	25	23	23
Transverse diameter .....	18	17	16.5	18.8	19	18	16.5	17	17	16
Height of pelvic inlet .....	21	21	19	20	21	20	18	19	19	17

According to Harms' method, one measures with the palm of the hand the distance between the anterior extremity of the symphysis and the vertically opposite part of the sacrum; the width or transverse diameter to be estimated by the greater distance between the ilia. Knowing the distance between the expanded fingers, the height and width of the pelvis can be ascertained.

I practice pelvimetry according to this method as follows: The cone-shaped hand enters the vagina. Palpation detects, superiorly, the anterior promontory; inferiorly, the anterior extremity of the ischio-pubic symphysis. Making a quarter turn with the hand, one rests the little finger upon the anterior extremity of the symphysis; the other four fingers are closed and the thumb is stretched out toward the roof; now one attempts to touch the sacrum with the thumb without removing the little finger from the symphysis. In this way the height of the inlet is estimated. Following the linea innomina-ta, the little finger is turned toward the right until the region

of the transverse diameter is reached. Now the hand, with its dorsal surface superiorly, is in a horizontal position. Next, the thumb and little finger are extended, to ascertain approximately whether the pelvic inlet has the normal shape or not. Thus one can investigate the pelvic dimensions by previously measuring the distances between the extended thumb and little finger or thumb and index finger respectively. Also, the distance between the cotyloid cavities can thus be calculated, and a stenosis recognized.

Diameters estimated after this method are always smaller than in reality. Especially the calculation of the vertical pelvic diameter is made difficult on account of the recto-vaginal excavation (*excavatio recto-vaginalis*). (St. Cyr and Violet.)

St. Cyr and Violet, employing Arloing's method, who established the diameters of the equine pelvis, calculated the diameter of the bovine pelvic inlet by distances measurable on the external surface of the living animal. According to their investigation, the height of the pelvic inlet (diameter sacro-pubien) equals 0.180 times the height of the animal at the withers, allowing an additional 5 to 15 mm. above and below. My observations show that in the Holsteins this coefficient is 0.15, allowing even an additional 1.5 cm.

The greatest pelvic width they calculated by multiplying with 0.36 the distance between the external ilial angles. Here also an additional 5 to 15 mm. is permissible. The circumference of the pelvic inlet, according to these estimates, equals 3.44 times the average sum of the diameters ascertained for the pelvic inlet.

$$ab + \frac{cd + cd - 2}{2} = \frac{2}{2} \times 3.44$$

In some animals examined by me I found the following diameters (expressed in centimeters):

Number	Height at withers	Distance between external and ilia angle	Distance between promontory and pubic crest	Height of pelvic inlet	Greatest width of pelvic inlet
1	126	49	23	19	16
2	127	55	24	20	18.3
3	135	56	24	21	18.5
4	130	55	22	20	17.5
5	125	49	23	18	16
6	129	51	25	19	16.5
7	127	50	22	19	16.5
8	125	48	23	17	15.5
9	132	53	26	21	17.5
10	129	52	25	20	17.5

## Differences the Result of Age.

The pelvis of a two year old heifer differs materially from that of an adult. It is of practical interest to describe a young or juvenile pelvis. In the bovines, ossification of the diaphysis with the epiphysis of the ilium only occurs at the age of two and a half years. In contradistinction to the solipeds, ossification in the bovines is from behind to before, so that there is first firm union of the ischium with the posterior branch of the pubis, and then pubic union (St. Cyr and Violet).

In a two-year-old heifer the symphysis is not yet ossified; this explains the fact, frequently seen in practice, that a heifer stands the forcible extraction of a calf better than a grown cow. How often does it not happen that eight to ten people together extract a calf from a heifer, or that other barbarous means are employed—for instance, a wagon wheel or lever—and that the owner reports a favorable termination. Such a happy course must be attributed, first, to the wanting ossification of the symphysis, and, second, to the elasticity of the juvenile pelvis, permitting of a slight transverse expansion.

The pelvis of a two-year-old heifer differs from a grown one as follows: The wings of the sacrum are shorter and narrower. The greatest width of the pelvis is less, the inlet is

compressed laterally, especially about the lower segment. The line drawn from the posterior iliac angle to the symphysis runs more perpendicularly. The pelvic passage also is narrower from side to side. We know that the plane running through the cotyloid cavities is least capable of expansion. For this reason the passage of the foetus may be retarded. The normally developed calf may be too large for such pelvic dimensions, to prevent extraction. Such a calf is known as relatively too large. These cases call usually for embryotomy. As age advances pelvic dimensions change and the pelvic canal widens. Therefore, an abnormal birth in a two-year-old, as just described, does not mean an unfavorable prognosis for the cow as a future breeder.

The pelvis of the calf is very elastic and compressible. As a consequence, a calf may be born alive although the distance between the trochanters exceeds the transverse pelvic diameter of the mother.

#### THE IMPORTANCE OF PELVIC DIMENSIONS IN OBSTETRICAL PRACTICE.

In man, an exact estimation of the pelvic dimensions is often of the greatest importance. The prognosis as to the course of labor in a patient with an abnormal pelvis can only be made after its diameters have been ascertained. It may become necessary during pregnancy when fear exists that the present pelvic deviations would not permit of a normal delivery, and in order to save the mother's life artificial abortion might be indicated (rachitic pelvis).

In the cow, lessening of the pelvic diameters is not very frequent. Malformations in man producing stenosis quite frequently lead to an examination, but are exceedingly rare in the cow. Animals with such abnormalities are not bred. Nevertheless, it is desirable that the veterinarian be acquainted with pelvimetry, for these reasons:

1. The relationship between the diameters allows us to form an idea of the shape and position of the pelvic bones and contour of the pelvic canal.

2. A knowledge of these dimensions allows us to understand the mechanism of parturition better, and shows how the foetus accommodates itself to the pelvic inlet. Discussion of the mechanism of parturition later will show how the calf gets through the inlet. Let it be mentioned here, that during expulsion the head, resting upon the forelegs, lies in the vagina, the sterno-dorsal diameter of the calf's thorax runs parallel with the vertical line, starting from the symphysis, the diameter of which is greater than the transverse diameter of the inlet, which runs parallel with the smaller bicostal diameter of the thorax.

This, therefore, is favorable for the passage of the foetus, although the dimensions become somewhat modified, as the ribs are pushed back on the thorax and can be compressed decidedly.

3. The practice of pelvimetry becomes necessary when during pregnancy stenosis is present, be it the result of fractures, formation of exostoses or dislocation of the sacrum.

During gestation, disturbances may be present or arise, inducing changes in pelvic dimensions. Fracture of the external angle of the ilium, quite common, does not produce pelvic stenosis; but fracture of the internal ilial angle or shaft of the ilium may do so; the dislocation, as well as the callus following it, may diminish the transverse diameter of the inlet. Fractures of the pubis and ischium may also lessen the pelvic diameters by callus formation.

Descent of the sacrum resulting from rupture of the ligamentous apparatus between it and the ilium, may materially decrease the height of the pelvic inlet. This dislocation is not accompanied by a disturbance in the union of the sacrum and last lumbar vertebra, but the most posterior portion of the vertebral column is lowered. The internal iliac angle projects, and one feels the tensely stretched longissimus dorsi. This condition is usually the result of dystokia, where the calf was extracted forcibly. The cow remains down for days or weeks after such a labor, arises then with great difficulty and remains quietly in the stable; when put out on

pasture in spring a swaying walk behind is noticeable for quite some time, which gradually improves until the animal is again served and impregnated. The sacrum stays in its abnormal position, as the wings are fastened by new connective tissue, which gradually becomes tendinous. In such animals the height of the pelvic inlet is decidedly decreased (Stockfleth).

In the year 1894 such a cow was presented here at the ambulatory clinic. She was pregnant for seven months and the sacrum had sunk completely between the internal iliac angles. On examination, the height of the pelvic inlet was 12 cm., while in the normal state it should have been from 19 to 20 cm.

For the owner's interest I considered it best to await the normal end of pregnancy, and to render assistance during parturition by performing a partial or complete embryotomy. The reasons inducing me to do so were: (a) milk production is better when the animal does the regular time than if abortion takes place; (b) the risks connected with artificial abortion; (c) the little danger of embryotomy.

Two months later the cow was again examined during labor pains, and since the circumference of the calf prevented its extraction *in toto*, embryotomy was performed. After removing the anterior limbs subcutaneously, the head just went through the inlet. The operation was finished in the ordinary manner. Four days later the cow went out to grass.

#### 4. Indications furnished by pelvimetry during the act of parturition.

This refers equally to extractions in normal and abnormal presentations. The knowledge of the pelvic diameters enables the operator to compare the dimensions of the calf with the greatest pelvic diameter and thus make birth easier.

I shall mention here an example. It often happens that when one half of the calf is born (head, neck and anterior limbs), the posterior extremity cannot glide through the inlet, as the calf's sacrum catches the mother's sacrum; here slight torsion of the calf suffices to extract it with but little exertion.

Many experienced stock owners know how to correct this abnormality, by fixing the calf and placing the cow in a dorsal position, when but little traction delivers the calf. The knowledge of pelvimetry explains to us what these people empirically but successfully executed.

By giving the calf a quarter turn, the trochanteric diameter of the calf is rendered parallel to the vertical diameter of the inlet; in other words, the greatest diameter of the hind quarters of the calf pass through the greatest diameter of the pelvic inlet.

The knowledge of pelvimetry explains many theoretical and practical data, and while the latter is not immediately perceived, its practical value cannot be denied. Many a little trick applied by the experienced obstetrician, and which in certain cases is of great use, is not thought of by the beginner. The practice of this vocation demands great circumspection on the part of the veterinarian and is surrounded by peculiar difficulties; for this reason nothing should be omitted which would enhance his theoretical, and especially practical, knowledge.

## 2.—The Soft Parts of the Genital Passage.

In describing the process of evolution, the changes in the texture and position of the uterus were discussed. The canal which the foetus must follow during expulsion, commonly termed genital passage, at the time of birth differs so much from that of the unimpregnated state, as to demand a detailed discourse.

The walls of the pelvic canal, the form and dimension of which have just been described, surround mainly the rectum, urinary bladder and vagina. When the rectum is empty—as is the rule during parturition—it having been emptied by repeated defæcation in the preparatory period, its walls collapse, leaving but a limited space between them. Besides that, the concavity of the inferior face of the sacrum is sufficiently deep to receive the rectal walls without materially decreasing the vertical pelvic dimensions.

The urinary bladder rests upon the floor of the pelvis. When emptied, it lies on the more elevated portion of the pelvic floor; when filled, it reaches up to, or even beyond, the anterior pubic border. It usually does not interfere with the passage of the foetus either during eutokia or dystokia, being mostly emptied in the preparatory period.

The reflexory contractions of the muscularis of the rectum and detrusor muscle of the bladder are of physiological importance in preparing the genital passage.

The internal wall of the genital passage is principally formed by the vagina and vestibule. Since they fill the pelvic cavity, the abdominal cavity is practically closed by them. In speaking of the uterus, it was stated that its attachment depends on two folds of the peritoneum, termed *mesometrium*. (Fig. 1.)

From the upper face of the uterus the peritoneum runs posteriorly to the vagina, turns upward and forward, to end in the serous lining of the rectum. The peritoneal fold thus formed has a space between its two layers communicating with the abdominal cavity, known as the *recto-uterine* or *recto-vaginal excavation*. That part of the mesometrium, respectively peritoneum, lining the lower face of the womb, runs also toward the vagina, about to the meatus urinarius, turning then downward and forward, covering the upper face of the urinary bladder. These vesico-vaginal folds enclose a space also connecting with the abdominal cavity, and termed the *vesico-uterine excavation*.

Both excavations play an important role in the aetiology of the prolapsus *vaginæ* and prolapsus *vesicæ*. This shows that only the anterior part of the vagina has a serous covering; its outer line posteriorly is an *adventitia*, composed of connective tissue and elastic fibres. This adventitia connects above the vagina with the rectum and below with the visceral layer of the pelvic fascia. Laterally, the adventitia joins the coccygeal muscles and pelvic fascia.

The vagina is least elastic where it becomes the vestibule, as certain muscles of that region end in a fibrous layer,

which might be looked upon as the deep perineal fascia, viz.: the perineal muscles, the sphincter of the anus, the depressor of the tail, the retractor of the vagina, and some muscular fasciculi extending between the broad ligaments and vulva.

As a consequence of these anatomical conditions, the expulsion of the calf experiences some obstacle at this spot; the dilatation of the vaginal walls is painful, on account of the numerous sensory nerves.

The vaginal wall further consists of a muscularis and mucosa. The muscularis shows externally longitudinal, internally circular fibres, increasing in number at the vestibule, which represents the thickest portion of the muscular layer. Between both layers are numerous elastic and fibrous fasciculi. The internal surface of the genital passage is a mucosa. Beginning at the spot where the foetus develops, and up to the vulva, viz., the whole tract through which the calf passes, we find a dilatable wall, the inner surface of which is lined with a mucous layer. In the unimpregnated state, the cervix uteri lies in the pelvic cavity or upon the anterior pubic border, but during advanced pregnancy in the abdominal cavity. That part of the cervix uteri extending into the vagina, known as the vaginal portion of the uterus, remains firmly closed during pregnancy. The anatomical arrangement of the cervix uteri permits it to be opened to such an extent that the body of the uterus and vagina form a common canal. As a consequence of the elasticity of the walls, it is possible to obtain an amount of dilatation only limited by the bony canal.

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## II.

### CAUSES, COURSE AND TREATMENT OF NORMAL BIRTH.

Whenever the foetus has reached full maturity, it is expelled. This ends intra-uterine life, and extra-uterine life begins. This course, subject to many deviations, including mother and foetus, is termed *birth* or *partus*, the act itself

inducing *birth-parturitio*. Parturition is a physiological process, which may take place without unfavorable sequels for mother and foetus, yet may produce many organic changes, which, in themselves normal, predispose to diseases and disturbances; therefore, to keep away evil influences, a prophylaxis is only successful where a thorough knowledge of the changes and mechanism of parturition exists. As the end of gestation approaches, certain phenomena announce the birth of the young animal.

What causes birth to occur at a definite time?

Many theories are offered in explanation. Some believe that the developed foetus acts as a foreign body; others that the fatty degeneration of the epithelium of the placenta plays an important role; again, others base their hypothesis upon a certain analogy existing between stomach, rectum and bladder. The latter organs, which serve as a reservoir, by the accumulation of their contents expand the contractile walls to an extent resulting eventually in relaxation of the sphincter and periodic evacuation. In the same manner the enlarging foetus causes a relaxation of the uterine sphincter, the uterine walls contract and expel the foetus (St. Cyr and Violet).

Smith (1848) identified physiological processes with oestrus and parturition.

Brown-Séquard alludes to the fact that the excitability of the uterus increases with advancing pregnancy; the presence of carbon dioxide in the maternal circulation, according to him, acts as a powerful excitant, producing uterine contractions.

Obernier combines the theories of different authors, and says: "Each period of menstruation excites uterine contractions, the tenth one sufficient to produce expulsions, the uterine nerves being at that time in a hyperæsthetic state." It is his opinion that the cause of birth in man is found in the occurrence of the tenth menstrual fluxion (Kehrer).

Franck was of the opinion that the same conditions prevail in the lower animals. He also believed that the acute genital hyperæmia of oestrus is identical in the causation of labor pains.

Many observations corroborate these theories; for instance, the occurrence of an abortion just at a time when in the unimpregnated state oestrus would set in; the expulsion of a so-called calf mummy during the period of oestrus.

Franck found, on conducting a post mortem of cows which died during or after parturition, one or more matured Graaffian vesicles almost ready to rupture in the ovary devoid of the corpus luteum. This led him to the deduction that the ovary which did not furnish the impregnated ovum might create reflectorily a genital hyperæmia by the pressure of the swollen vesicles upon the sensory nerves, same as during oestrus. According to Ellenberger, the act of birth, the changes which the gravid uterus undergoes, as well as the periodical explosive contractions following fecundation, are simply hereditary.

### 1.—Labor Pains—Dolores.

Generally speaking, the words "labor pains" represent the expulsive forces; in a more concrete sense, the uterine contractions. The contractions begin in the muscles of the broad ligaments, next contracts the uterus, and in the further course of parturition the muscular elements of the vagina and vestibule participate. These contractions are periodical; they occur now and then, with definite intermissions.

Various causes induce uterine contractions. The uterus may contract as the result of irritations originating in the cerebellum, medulla oblongata and spinal cord (Spiegelberg, Frankenhauser, Körner, Obernier); but the uterus itself harbors nerve centres, stimulation of which produces contractions. Sensibility is conducted via the spinal nerves. We already stated that advanced pregnancy means a hyperæsthetic state of the uterus. Excitability of the uterus also increases with rise of temperature and hyperæmia of this organ. We further know that dyspnoic blood—that is, blood laden with carbon dioxide and wanting in oxygen—is exciting to the uterus. In all probability the stimulus leading to contraction arises in the uterine nerve centres. Mechanical

influences may also cause uterine contraction, which will be discussed fully under "Abortion."

As a result of uterine contraction the placental circulation is lessened and a small amount of blood enters the placenta. During the labor pains the foetal heart-beats become slower. One looks upon this as an excess of carbon dioxide in the foetal blood. The increasing frequency of the maternal heart-beat during labor pains causes a rise of pressure in the arterial system—a compensation, to a certain extent, for the limited amount of blood following narrowing of the arterial channels (Kehrer). The contractions of the uterus are not of a peristaltic nature, as the whole contractile surface acts together. The pressure following labor pains is considerable.

Poulet ascertained the intensity of labor pains manometrically by an apparatus termed by him "Tocograph." This instrument transfers the pressure, the result of the uterine contraction during labor pains, to a manometer, which records it upon a rotating roll of paper—that is, in the same manner as we produce pulse and respiratory curves. The apparatus of Poulet consists of, first, a strong but compressible caoutchouc ball; the ball is introduced into the uterus, between its walls and the foetal envelopes, when the latter are torn between the uterine walls and body of the foetus. Second, it consists of a mercury manometer, a U-shaped tube, partly filled with mercury, and one arm of which communicates with the ball by means of a caoutchouc tube, while the other arm has a float, the end of which is provided with a pen to register the movements of the mercury. When the apparatus is started without introducing the caoutchouc ball into the uterus, the pen records upon the rotating paper a horizontal line, termed zero. On introducing the ball in the proper manner into the uterus during labor pains, and connecting it with the apparatus, the water in the ball becomes compressed and the pressure is transferred to the mercury, causing it to rise in that arm of the U tube with which the ball is connected. During the intermission the mercury falls, registering a horizontal line. Each intermission produces the same hori-

zontal line. Poulet called it the line of tonic uterine contraction. In the cow this line is 44 to 48 mm. above zero, and shows no fluctuations (St. Cyr and Violet). In the woman, the uterus during the periods of intermission is almost at rest, the line being nearly horizontal; the line of tonic uterine contraction in the woman is 15 to 20 mm. above zero. As soon as contractions begin, the mercury column constantly rises and falls until a period of rest occurs.

A labor pain is made up of a series of momentary contractions, followed by relaxation and diminution of uterine tension. Each contraction produces a rise of mercury from 80 to 110 mm. (St. Cyr and Violet). By means of the toco-graph, we may measure the force exerted by the contracting uterus and the movements of its auxiliary muscles, viz.: abdominal compression.

Each cubic centimeter of the foetus experiences during a strong contraction a pressure of 200 to 300 gr. (St. Cyr and Violet). When the surface of the calf, barring the extremities—that is, up to the patellæ and elbows—represents 32 dm.<sup>2</sup>, the calf receives a pressure of 640 to 960 kg. During violent throes—that is, a continuous tonic contraction, known as *tetanus uteri*—the uterus becomes anæmic, resulting possibly in asphyxia of the foetus. Should a torsion of the uterus or a closed os uteri be present, or the expulsion of the foetus retarded on account of its excessive size or abnormal position, labor pains are unsuccessful, and in due time uterine fatigue sets in. When the contractions after exhaustive labor are weak and of short duration, one speaks of an *anony of the uterus*; while limited uterine contractions, with a long period of rest, are termed an *inert uterus*. Total absence of contractions are the result of exhaustion or paralysis of the uterus.

Labor pains, according to their effects, are divided into: (1) Preparatory pains; (2) expulsive or labor pains; (3) post partum pains.

*Preliminary stage.*—Preparatory pains are such uterine contractions where the abdominal pressure is limited. These pains loosen a portion of the foetal placenta and open the

cervix uteri; following this, they assist in rotation of the foetus.

*Stage of Expulsion.*—Expulsive pains are strong, and their intensity is greatly assisted by the auxiliary abdominal muscles. The intermissions are here short. The muscles of the vagina and vestibule contract reflexly, seen by the periodic retraction of anus and vulva. Immediately after birth these contractions decrease in intensity.

*Post partum stage* expels the after-birth, they are less strong and have long periods of rest. Normally, the abdominal muscles are not concerned in the production of post partum contractions, but occasionally the uterine contractions are assisted by them. Especially are those cows exposed to severe post partum pains which lie with the hind quarters lower than with the anterior extremities.

## 2.—Course of Normal Birth.

How do we know in the cow that birth is approaching?

While dealing with the phenomena of pregnancy, I already hinted at the fact that certain signs manifest themselves, especially in the last month of gestation. The swelling of the udder, beginning three to four weeks before birth, is one of the most important symptoms; also the nature of the lacteal secretions indicates approaching birth. As long as the milk is watery and thin, birth of the calf is not imminent; but when milk is whitish-yellow and colostrum-like, it soon occurs.

To define the time of birth is necessarily of great importance to the stock-owner. With him it becomes a habit to visit a cow about to calf every night before retiring, in order to see whether she ought to be watched that night or not. Many men become very accurate in this respect by practice, but even the most experienced one will err. I myself have seen a calf born within two hours, while a careful survey previously made did not indicate an immediate delivery.

Experience teaches us that the end of gestation and the

beginning of parturition is characterized by certain prodromes pertaining to the preliminary stage.

1. *Falling in of the Pelvic Ligaments.*—By placing the hand laterally to the tail upon the posterior border of the sacro-ischiatic ligaments, we notice that they become indistinct, or, as it is termed, they have fallen in.

The relaxation of these is not exclusively the result of infiltration, but also depends on mechanical causes (Berdez, *Schweiz. Archiv.*, 1882, p. 188). The relaxation, according to Berdez, follows the approach of the ischial tuberosities and the roof of the pelvic cavity, the latter due to a rocking movement of the pelvis. As soon as the contractions of the uterus relieve the severe tension of the abdominal parietes, the pelvis rises posteriorly. The antagonists of the rectus abdominis allow the pelvis to drop a little anteriorly, thus bringing the ischial tuberosities closer toward the sacrum, and the ligaments relax. This explains also why the pelvic ligaments may sink in decidedly within a few hours.

The position of the pelvis shortly before birth is obliquely downward and forward. As a consequence, the gradual slope of the floor of the pelvis toward the lower abdominal region assists the act of parturition (Berdez).

Some cows, as the result of a previous dystokia, when old, tuberculous and cachectic, have relaxed ligaments; in them this symptom is of no value during approaching labor.

2. *Swelling of the Udder.*—The sudden filling with milk is a phenomenon heralding the end of gestation. Already since the beginning of the last month the udder gradually increases; at the end of the period of pregnancy it remains stationary for some days, when now suddenly the udder swells considerably and the early birth of a calf may be expected.

In some cows the swelling of the udder becomes so enormous as to worry the owner. The tumefaction may extend posteriorly up to the vulva and anteriorly to the sternum. The udder may be strutting with milk to such an extent that the owner empties it. This procedure is not objectionable from a hygienic standpoint; in fact, it is to be recommended

in such cows, irrespective of the objections raised by the owner.

3. *Falling in of the Flanks*.—This is very plainly visible laterally to the transverse processes of the lumbar vertebrae and behind the last ribs. The contour of the lumbar vertebrae and sacrum appears much sharper.

4. *The Discharge of Mucus from the Vulva*.—The cervix uteri closes because its plicated folds come together. By the secretion of a glairy, viscid white mucus, depositing itself like a stopper upon these folds, the uterine opening is firmly guarded. As a result of a very limited dilatation of the cervix uteri one or two days before birth, this glairy mucus begins to lose hold, and often appears in long and thick filaments at the vulva. Occasionally this mucus is slightly red in color, caused by a little blood from the chorion and some of the accessory cotyledons near the internal uterine opening.

5. *Swelling of the Vulva*.—Physiological tumefaction of the vulva occurs in the last days of pregnancy. It is caused by an active hyperæmia, reflexly instituted by the ovaries. This swelling is not always present. In some cows it is wanting while present to a great extent in others, and termed *ædema of the vulva*.

The preliminary or preparatory stage is followed by dilatation of the os uteri. The cow, which up to this time stood, or laid down from time to time, becomes uneasy, paddles behind, whisks the tail, defecates and micturates frequently and in small quantities, lies down and rises often. The uterine contractions, previously quite weak, now increase in intensity; now and then a throe is assisted by the abdominal muscles. The presence of the dilatory throes is recognized by the clonic contractions of the perineum; the muscles which retract the superior wall of the vagina when the tail is fixed, are also actively concerned. During these contractions of the uterus the cervix uteri becomes dilated. What causes dilation of the os uteri? In the first place, the contractions of the uterus, cervix and vagina. The dilatation thus affected, and which might be termed an active one, is nevertheless limited and far

from being sufficient. After the cervix is once open further dilatation is continued from within the uterus, and therefore is a passive one.

By the contractions of this stage, a portion of the chorion, which lies close to the inner opening of the cervix uteri, is detached from the maternal placenta and is pushed forward in the shape of a bladder by the allantoic fluid, which is under high pressure. As a result of the pressure exerted by this bladder against the internal uterine opening and its adaption to the form of the cervical canal, dilatation slowly progresses.

Anatomy teaches us that the mucous folds (palmæ plicatae) of the cervix uteri lie in such a way that the uterus may be probed from within to without, but not *vice versa*. As soon as the cervix uteri is somewhat dilated, the secretion of the palmæ plicatae advances into and beyond the vagina,—thus corroborating the anatomical peculiarity just mentioned. In this stage, therefore, we see long viscid streams of mucus appear at the vulva. The cervix is gradually dilated by that segment of the envelopes filled with the foetal liquor. An examination per vaginam at this stage reveals the globular fluctuating foetal envelope, completely filling the whole vagina.

We term it the water-bag, since it contains foetal fluids. This water-bag is composed of the chorion and allantois containing the allantoic fluid, but since the chorion is less elastic than the allantois, and held firmly by the placenta, the former ruptures already on passing through the cervical canal, so that the water bag finally consists only of the allantois.

At the end of this stage the cervix uteri has widened to such an extent that the vagina and uterus form a common cavity. At the end of this stage the intensity of the contractions increase. The previous statements permit of the deduction that the water-bag must necessarily advance as far as the vagina—yes, even beyond the vulva—to sufficiently dilate the genital canal. It does not only dilate the cervix uteri, but also the vagina; therefore it prepares the canal for the passage of the foetus.

In order to have birth take a regular course, it is of importance that this bladder should not rupture within the genital passage. When the water-bag reaches the vulva, it appears as a bright glistening tumor of more or less bluish tinge, separating the vaginal lips. In the further course this bladder appears beyond the vulva as large as a head, and often bursts as the cow rises.

#### STAGE OF EXPULSION.

At the moment when the water-bag ruptures, be it the result of violent pains or manual interference, a part of the allantoic fluid escapes. This is called the rupturing of the water-bag. The uterine muscle acts directly upon the foetus as soon as the allantoic fluid enters the pelvic canal, especially after this fluid escapes. The uterine contractions change the position of the calf. The intrauterine costal presentation is changed into an abdominal one, the head and forelegs becoming extended at the same time. The contractions introduce the young animal into the pelvic canal with its head lying upon the anterior limbs. As an immediate consequence of the rupture of the allantoic bladder, rotation of the foetus about its long axis takes place.

The amnion is pushed forward in the shape of a bladder. The allantoic bladder has already prepared the passage for this bladder, within which the foetus and forelegs rest. A few strong pains, assisted by abdominal pressure, and the amniotic bladder plus foetus are forced into the vagina. As soon as this bladder manifests itself between the lips of the vagina, it likens the allantoic bladder exactly. Its color is whitish, glistening. The claws are visible through the thin, transparent amnion. Strong throes advance the calf further and further; the amniotic bladder bursts, followed by an escape of viscid, slimy, opalescent amniotic fluid. The nature of the escaping liquor permits us to recognize whether the amniotic or allantoic bladder has ruptured. As soon as the amniotic bladder bursts, violent throes drive the foetus, lying on its abdomen, through the pelvic canal.

After the anterior extremities have passed the pelvic inlet and the head is born, the uterus contracts upon the hind

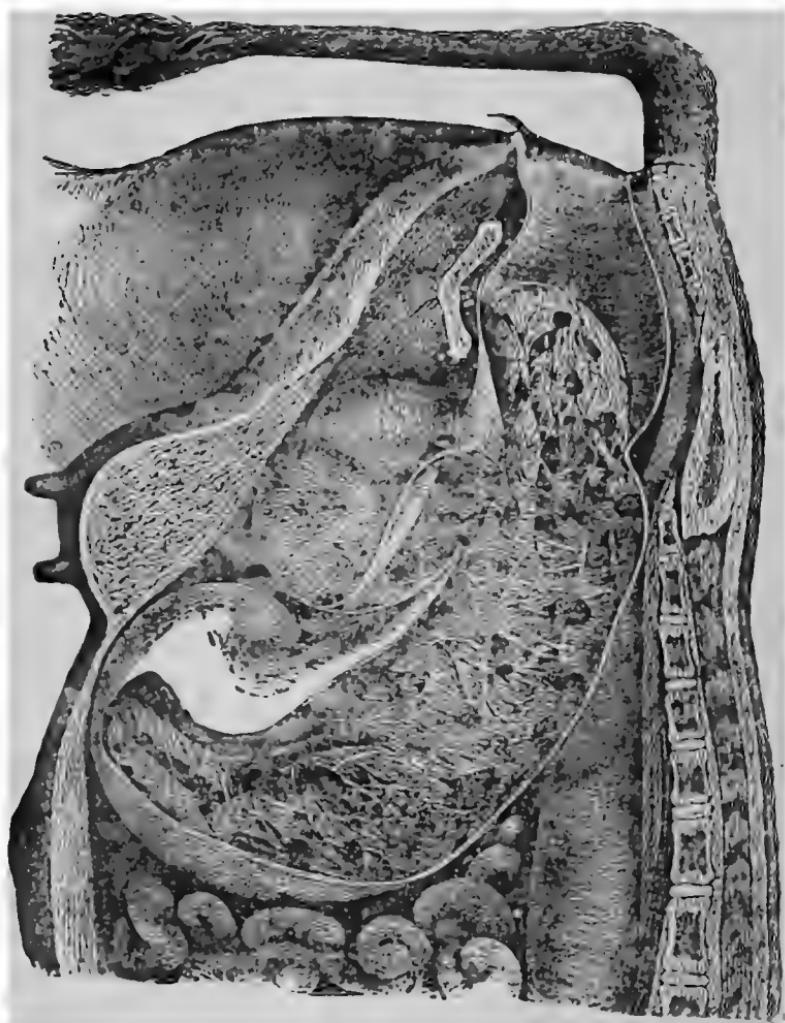


Fig. 13.—Normal Birth.  
(Skelet).

quarters, and, with the aid of the abdominal compressors, the foetus is expelled.

The genital canal offers two parts where the passage of

the foetus may meet with obstacles, viz.: the cervix uteri and where the vagina runs into the vestibule. The former does not interfere, provided it is fully dilated. In primiparæ it often happens that the cervix uteri is not sufficiently opened, and the foetus is detained slightly at that spot. We proved previously that this is partly caused by the early rupturing of the allantoic bladder within the cervix uteri.

The vagina is slightly contracted where it runs into the vestibule. Here also the moving foetus meets occasionally with difficulties and detention. At this spot the passage of the calf is extremely painful, on account of its great supply with sensory nerves. Birth is often retarded at this place, especially in primiparæ.

FœTAL DIMENSIONS WHICH MUST CORRESPOND WITH PELVIC  
DIMENSIONS TO PERMIT NORMAL BIRTH.

The following dimensions of the foetus demand consideration:

1. The transverse diameter of the head, or the bitemporal line, which is quite pronounced in the calf, must be smaller than the greatest width of the pelvic inlet or passage.

2. The vertical diameter of the head, as well as the diameter of the carpus, must not be greater than the height of the pelvic inlet. The vertical diameter of the pelvic passage and outlet do not offer difficulties. The vertical diameter of the pelvic canal is greater than the one of the inlet, on account of the convexity of the os sacrum and concavity of the pelvic floor, while the outlet is expansible in an upward direction by the mobility of the coccygeal vertebrae.

3. The vertical diameter of the thorax (sterno-dorsal diameter) is always greater in the matured calf than the height of the inlet, while the bicostal diameter plus both shoulders is smaller than the greatest pelvic width. Nevertheless, normal birth may occur, as the ribs, by accommodating themselves to the pelvic inlet, are pushed back. In this manner the vertical thoracic diameter is lessened materially, without increasing the bicostal diameter. As a result of the backward movement of

the ribs, the vertical diameter of the thorax may be decreased by 6 cm. When the withers of the calf once pass the inlet, its further passage becomes much easier.

4. The distance between the two external iliac angles in most cases is smaller than the greatest transverse pelvic diameter. The hind-quarters of the calf often apparently get caught after the anterior half is already born. This is not always the consequence of incompatible dimensions, examination revealing that both iliac angles have passed the pelvic inlet.

5. The distance between the trochanters, also known as the bicoxal diameter, in order that the course be a normal one, must not exceed the greatest width of the inlet or transverse diameter of the maternal pelvic canal.

6. The distance between the two patellæ is especially great in meaty calves. When greater than the transverse pelvic diameter, birth is retarded. It will be fully discussed in the chapter on the "Relatively Too Large Foetus."

At birth, the anterior or head presentation is most common. Here the chest lies opposite to the pelvic inlet. Anterior presentations are the rule in the cow; of course, breech or posterior presentations, where the croup faces the inlet and the calf is born hind legs first, also occur. The intrauterine position of this breech presentation is a costal one; that is, the foetal back is turned toward the right abdominal wall of the mother, the head toward the flexed carpi, while the hind legs are flexed at the hocks, the two hocks pointing toward the pelvic inlet. Here also a rotation of the calf around its long axis takes place; as soon as the cervix dilates, the water-bag enters the genital passage and the water partly escapes. By this rotation the calf's back comes opposite to the mother's spinal column and the inferior face of its abdomen is turned toward the maternal abdomen; the hind legs, extended and surrounded by the amniotic bladder, which they propel, pass into the cervix uteri.

During the expulsive pains, the hind quarters pass the pelvic inlet first, then the thorax, and finally the head.

Although parturition often terminates favorably, nevertheless the posterior presentation frequently gives rise to dystokia.

We noticed already that dilatation of the cervix uteri depends on the pressure exerted upon the internal opening of the cervix, by the segment of the chorion and allantois filled with foetal liquor. This factor is also prominent in a birth with posterior presentation. As the result of the extension of the hind legs, the chorion-allantoic bladder is immediately followed by the amniotic bladder, which contains the claws of the hind feet and which now glide easily into the cervix uteri. But as the calf's pelvis presents itself before the inlet, the dilatation caused by the water-bag is often insufficient to permit the passage of the foetal pelvis, and expulsion is thus interfered with. In the anterior presentation the larger amniotic bladder containing head and fore legs produces complete dilatation. The contractions now increase in violence, and since the cervix is now dilated mechanically by the foetus, this obstacle may be soon removed. After the hind-quarters are born, thorax and head meet with no difficulties. Those complications which may yet arise will be discussed later.

During normal birth, with either anterior or posterior presentation, the calf lies in a postero-anterior plane; primary transverse presentations do not occur in the cow. The intra-uterine position of the calf is the result of its accommodation to the form of the uterus. The back of the calf lies toward the convexity of the uterus. The largest portion of the calf, its hind-quarters, lies in the most roomy part of the horn, the head in the narrower part and in the body of the uterus. This theory, also called the *accommodation theory*, readily explains why a head presentation in the cow is the rule.

In man, one tries to explain frequency of the head presentations by the fact that the point of gravity is nearer to the head than to the breech or lower extremities. This theory—*gravity-theory*—has also been applied to explain the frequently occurring anterior presentations in the uniparous mammalia. (Battlehner, Kehrer, l.c. page 105).

## THE TREATMENT OF NORMAL PARTURITION.

It may happen that the veterinarian is called to superintend a case of normal parturition in the cow. The practitioner under such circumstances would observe many a thing with which the beginner, of course, should acquaint himself.

Provide sufficient room and a soft bedding when the first signs of approaching parturition announce themselves. Sufficient room is easily obtained by removing cows on the right and left. Since the cow moves about, lies down and rises during the preliminary stage, more room is required. In stables where we find behind the stall a gutter for faeces and urine, a board is best placed upon it, which may be looked upon as an elongation of the stall. This board is covered with straw. Now the hind legs of the cow cannot step into the gutter nor can they suddenly slip into it during violent throes.

At each birth sufficient assistance and material should be present. By sufficient help I mean that two strong persons besides the obstetrician are ready to assist in traction when such is indicated. As sufficient material I designate : two or three ropes ; two round sticks, each 32 cm. long and 4 cm. in diameter, being a little thicker in the middle than at their ends ; 500 g. linseed oil, soap, lukewarm water and some towels. In some cases, when the udder is so enormously swollen that the cow cannot lie down, it may become necessary to empty the udder. This often renders the previously excited animal quiet, and the act of parturition begins.

For the present nothing else is necessary but to watch the animal. The preparatory stage may be a long one in the cow, in some cases half a day and more ; in some animals this stage occasionally escapes our observation, as the cervix uteri is already dilated on our arrival. Cases of slow parturition or a prolonged preliminary stage should not worry us too quickly. When it extends over more than four hours, an exploration per vaginam, under proper precautions, to ascertain the state of the cervix, may be instituted.

The water-bag, so important in the dilation of the genital passage, must not be ruptured until the genital passage is fully dilated, so that all folds of the neck of the womb have disappeared. It usually ruptures when meeting with resistance in the genital passage or when protruding at the vulva. A part of the foetal liquor then escapes. Shortly after it is followed by the amniotic bladder. The time between the two may be short—ten to fifteen minutes—but may amount to several hours. During the pains, quite intense at this stage, the cow rests, most comfortably upon the right side. I have often observed that it is very uncomfortable for the cow to lie upon the left side and that she rises immediately. The position of the rumen explains sufficiently why lying upon the left side when continued for some time creates tympanites and dyspnoea. In cases of very large foetus, or twins causing great distention of the belly, parturition always should take place on the right side.

Even during normal parturition the act is retarded, when the amniotic bladder, advanced by the head lying in the shape of a wedge upon the fore legs and passing through the genital canal, appears between the lips of the vulva. It is due to the resistance offered in the vestibule to the dimension of the head, both its bitemporal and vertical diameter. The passage is here very painful. While overcoming this obstacle the animal issues an expiratory moaning, or may even bellow. When the head is visible between the labiæ and past the vestibule, both fore legs arrive beyond the vulva up to the carpi. Now the amniotic bladder bursts, the fluid escapes, and, unless the calf is very large, a few expulsive pains suffice to expel it completely. It gradually has become a habit to open the amniotic bladder in order to extract the calf. The amniotic bladder must be opened when the legs up to the carpi and the head as far as the eyes are visible beyond the labiæ, in order to prevent complications following an eventual inspiration of the calf. As soon as parturition has advanced to this effect, the placental circulation ceases, be it because the umbilical cord has torn by having been pinched at the pelvic floor, or because pressure

put an end to this blood supply. However, at the moment when this occurs respiration begins, which, when the amnion is closed, induces deglutition of the amniotic fluid. After the amniotic bladder has ruptured, the expulsive forces may be assisted by gentle traction.

Since it is hardly possible to pull sufficiently with the hands on account of the slippery skin, ropes fastened to the pasterns by means of a loop, and wrapped around a stick at its free end to prevent them from cutting the hands, are employed. Attention must be paid that no foetal envelopes enter between the loop and the shinbone.

How strong shall traction be and in which direction is it to be exerted?

Many owners have the bad habit of opening the amniotic bladder, and rope the fetlocks and extract the calf as soon as the claws of the fore-legs appear at the vulva. There is no reason for such hurry. Nor need one fear that the calf will asphyxiate after the amniotic bladder ruptures; but there is danger to rupture the upper border of the vestibule when traction is employed too early and too strongly. Only when the muffle appears between the vulva may traction upon the fore-legs be practiced. The force developed by one or two men suffices in normal parturition. When the head is born, the act of parturition ceases for a moment as the withers pass and as the trochanteric diameter passes through the maternal pelvic inlet.

Primiparae at the age of two years often experience difficulties as the trochanters of the calf pass between the cotyloid cavities of the mother. Pelvimetry showed that the juvenile pelvis is deficient in its transverse diameter of the pelvic canal.

In which direction is traction to be exerted?

When traction is employed, it must be exerted in the same direction in which expulsion takes place. As the calf enters the pelvic canal, traction is to be exerted in the direction of the os sacrum; as it passes through the canal one pulls in the opposite direction, while upward traction is indicated as the calf leaves the genital passage.

Traction on the calf and labor pains must occur synchronously. It is senseless and dangerous to pull during the intermission. The obstetrician recognizes a pain by the bulging of the left flank, provided the animal lies on its right side; traction at that time is doubly effective.

Normal parturition with a posterior presentation, where the hind-legs enter the pelvic canal first, requires a little different treatment.

The amniotic bladder is pushed into the vagina by the hind-legs; here the claws of the posterior limbs can be seen already before the cervix is fully dilated. On complete rotation, the back of the calf lies against the spinal column of the mother, the fetlocks point toward the sacrum and the plantar surface of the hind claws upwards. The uterine contractions occasionally advance the hind-legs as far as the fetlocks. In this case the amniotic bladder must be ruptured and parturition assisted by gentle traction.

In this presentation there is constant danger of rupturing the umbilical cord in consequence of this intrauterine respiration of the calf, aspiration of amniotic liquid and suffocation. Under these circumstances it is desirable to hasten parturition to save the calf.

The above shows that aid in normal parturition principally consists in preventing complications. We know from experience, that when the water-bag is ruptured too early the soft genital passage is insufficiently dilated, and, in consequence of traction on the calf, injuries of the cervix and vaginal walls may arise. In primiparæ, where parturition is often very slow, we must always try to prevent ruptures of the above-named parts, and especially the perineum. In such a case the use of lubricants, as, for instance, oil, is indicated. This procedure is a favorite one with many breeders.

The question is often raised whether it is necessary to explore in normal parturition.

If the course is perfectly normal, it is advisable to abstain from exploring the parts; but, just as soon as an abnormality manifests itself, the genital passage must be

examined. But the following must be remembered as regards infection :

The perinæum, the labiæ and surroundings, as also the tail, are to be thoroughly cleansed with soap and luke-warm water. It is well to do this at the outset of parturition, although micturition and defæcation during the preparatory stage may require a second cleansing. The tail is held to one side by an assistant. The obstetrician washes hands and arms with soap and warm water, rinsing both with carbolized or creolinized water, and dresses them with pure oil. Of course he should take care to cut the finger nails and remove any dirt which may be below the nails. After this precaution he may proceed to make an exploration. When this examination is made before the cervix is fully dilated, he still finds the calf in its intrauterine position ; that is, lying on its side which is normal, and which by rotation is changed into the abdominal one later. At the end of normal parturition the task of the obstetrician has not yet ended. The animal, fatigued and exhausted from the act of parturition, usually lies quiet for a time. He now takes care that the position of the cow be such that the hind-quarters are not lying too low. Such a position causes violent after-pains which may produce eversion of the uterus. Many breeders, therefore, induce the cow to rise as soon as possible. The cow should now be rubbed down well to stimulate cutaneous circulation and to equalize the changed circulatory condition.

Food at first should be of easy digestion and not too plentiful. Warm gruels of linseed, wheat or barley flour and a little hay are best. Green food or cold water must not be given. (In our country, where cows are generally used to green food, no harm will follow its moderate ingestion.—W.)

Blood and dirt are removed from the udder by soap and warm water, and the cow is milked.

The animal now enters the post-partum period. The expulsion of the foetal membranes is yet to occur. Other precautions which are to be taken at this stage are fully treated under the processes of involution.

## THE NEWLY BORN ANIMAL.

As soon as the calf is born normally, severing of the umbilical cord takes place without intervention on the part of the obstetrician. In bovines, the navel string, being of little resistance, tears easily; before the fore-quarters of the calf pass the vulva, connection between mother and the young has already ceased to exist.

Although the rupturing of the umbilical cord usually gives us little concern, it is nevertheless a very important point.

I shall explain this further and describe how the umbilical cord tears and what the consequences are when the circulation stops to run through it.

Rupture of the umbilical cord of the calf differs from that of other animals. At birth of the calf the umbilical cord is rendered so tense that it ruptures. The umbilical vein tears in the umbilicus, while the umbilical artery, after being severed, retracts into the subperitoneal tissue. Therefore, this rupture in the calf takes place within the abdominal cavity. No hemorrhage follows rupture of the umbilical arteries on account of the energetic contractions of the muscularis of the arteries, which comprises the whole length of the umbilical arteries. After parturition the foetal and membranous portion of the artery is anæmic. The peripheral piece of the umbilical vein at the site of rupture is cone-pointed and full of blood, while the intra-abdominal portion of the vein often contains a coagulum (Kehrer).

After circulation through the umbilical cord ceases, important changes occur in the calf: primarily, respiration. It has been mentioned previously that by asphyxia of the foetus intra-uterine respiration is called forth. Inspiratory movements may be provoked in the foetus by compressing the umbilical cord.

It is a fact that the young animal begins to breathe as soon as the cord tears. The thorax expands and the first respiratory movement is a slow inspiration, accompanied by rales caused by the presence of amniotic fluid in the respiratory tract. The

first respiratory movements are slow and deep, with decided movement of the abdominal muscles. A few moments later, slimy masses are expectorated and respiration becomes regulated, so that the respiratory movements become less deep and slow, but more frequent.

Many physiologists have ventilated the question, What causes the first respiration? Haller still thought that respiration depends on the various painful sensations, or probably desire for food. Buffon alludes to the stimulus exerted by air upon the olfactory nerves and upon the mechanism of respiration. Others believed that the influence of the cold air induces respiratory movements reflectorily. According to Kehrer, Blumenbach started the correct investigation of this question. He looks upon the cessation of the placental circulation as the primary cause of respiration, which explanation has been accepted by many. Kehrer thinks that experimental tokology should solve the question how far external irritations, as temperature of air and other natural processes occurring at parturition, are concerned in the production of the first respiration. For this purpose he experimented with newly born dogs still within the amniotic sac, by placing them into water of body temperature before the first respiration became manifest. The puppies were quiet for one-fourth to three minutes and now and then opened and closed the mouth. After this time they began to squirm about and raised the head as if to catch air. Distinct respiratory thoracic movements were appreciated. Whenever the entrance of air was prevented, the animal attempted to breathe once or twice per minute, at the same time undergoing the above mentioned convulsive movements. Any pressure upon the body awoke the animal and instituted a strong respiration. After 14 minutes, respiration stopped and the heart ceased to beat after 36 minutes. Whenever the dogs were removed from the water, after lying in there for a few minutes, respiration began at once and the frequency of the heart-beats increased.

From the above Kehrer makes this deduction: "The first respiration follows the interrupted placental circulation as a

physiological necessity, but that external stimuli (lowered temperature, pressure) ordinarily are the first causes of respiration; in fact, exert their influence before the disturbed placental circulation creates a desire for oxygen by the organism." Increase of carbon dioxide and want of oxygen may irritate the respiratory centre, which also may occur by the influence of air upon the skin.

In consequence of the first respiration, many circulatory changes take place in the young animal.

The expansion of the lungs in consequence of the dilatation of the thorax, the blood of the right heart is strongly aspirated into the lungs through the pulmonary artery. Now the blood current no longer runs from the right to the left side by the oval foramen, but from the right auricle into the right ventricle and from here by the pulmonary artery into the lungs, and not by Botalli's duct into the posterior aorta. Botalli's duct closes, and since no blood flows through it, the intima folds upon itself and the lumen disappears. According to Ellenberger, this lumen is often already closed after four to six weeks. Since no blood flows from the pulmonary artery to the posterior aorta, blood pressure in the latter is immediately lessened after parturition. After the pulmonary circulation has been established, blood pressure in the left auricle increases; the valve of the oval foramen places itself over the opening, and the foramen ovale is closed, this being assisted by the flow of the blood toward the right ventricle. After one or two years the valve of the oval foramen is united to the septum, while it may be completely closed in a six months old calf (Franck).

The increased blood pressure in the left heart causes hypertrophy of its walls.

The umbilical arteries become obliterated and form the round ligaments of the bladder. The umbilical vein is compressed, its lumen disappears, to form later the round ligament of the liver.

The body temperature of the young immediately after birth is a little higher than in the mother (Franck).

When the calf is born, the whole skin of the body is covered with a dirty, slimy, yellow mass, the *vernix caseosa*. In some calves the color of the mass is intensely yellow. It consists principally of skin secretions and amniotic fluid. The cow, when the calf is placed before her, licks it, and many even turn it over with the horns to lick off the *vernix caseosa*. This irritates the skin and stimulates respiration reflexly. It is advisable to allow the mother to stimulate the function of the skin in this manner. If this is impossible, or where the cow refuses it, the calf must be rubbed dry. Soon after birth the calf attempts to rise; while meeting with little difficulties at first, it finally succeeds, and the animal stands with fore and hind legs spread apart trying to sustain equilibrium.

As a rule shortly after birth, rarely during parturition, the first defæcation takes place, when a part of the meconium is expelled. The meconium, or foetal faeces, forms the contents of the intestinal tube during intrauterine life. It consists of an amniotic fluid which has been swallowed, respectively constituents which may happen to be contained in that fluid, as hairs, epidermal scales, intestinal epithelium, mucus, coloring matter and biliary constituents. In color meconium appears as a yellowish, pitch-like mass, filling the whole of the intestinal canal. Its color is yellow and its consistency thinner in the small intestines. Inspissation of the faeces in the colon is already a resorptive ante-partum process. The first defæcation may be caused by the pressure exerted by the diaphragm during the first respiration upon the intestinal mass, as well as by a collateral hyperæmia following chilling of the skin (Ellenberger).

The first milk or colostrum which the calf receives may increase peristalsis; being rich in fats and salts, it has somewhat laxative properties. It is frequently a fact, that ingestion of colostrum is followed by intestinal evacuation. It is therefore advisable to give it to the calf.

Micturition takes place soon after parturition. The fundus of the bladder contracts after rupture of the urachus and umbilical cord.

### III.

## INVOLUTION OF THE UTERUS.

After the young has been born, its envelopes are still united to the uterine mucous membrane. As soon as the uterus contracts after parturition, circulation ceases in the envelopes.

All foetal membranes are termed after-birth, or placenta, as their expulsion takes place soon after birth. The stage during which they are expelled might be termed post-partum period. Parturition therefore can be divided into the preliminary, expulsive and post-partum stage.

### I.—EXPULSION OF THE FOETAL MEMBRANES.

The foetal envelopes are still connected with the uterus by the foetal placenta. The chorion attaches itself, as previously explained, to the maternal placenta, or cotyledons.

We know that on the surface of the cotyledons the villi of the foetal placenta dip between those of the maternal placenta. The concave foetal placenta surround the maternal placenta like a pot. As long as the circulation exists, the villi of either are filled and pressed against each other. The exchange of nutritive elements occurs at the bright seam between the placental villi, which is formed by the uterine milk, cessation of circulation following uterine contractions after parturition loosens the union between the villi. Already the circulatory changes disturbed the union between the chorion and cotyledons.

The expulsion is effected by contractions of the uterus—the so-called after-pains or dolores post-partum. The cotyledons do not contain any muscular bundles. Therefore the conditions for the detachment of a multiple placenta are less favorable than for those of a disseminated one. The numerous placenta of the cow do not separate from the uterus simultaneously, but one after the other.

The foetal placentæ lying close about the internal opening of the cervix become already detached during the labor-pains which dilate the cervix uteri, detachments also occur now and then during the expulsive stage. Any placentæ separated by the uterine contractions follow, together with the remaining foetal envelopes, the direction of the cervical canal, and may hang from the vulva. As a rule, shortly after birth of the calf a thin cord hangs from the vulva, usually a piece of the amnion, of 20 to 30 cm. length. The piece gradually becomes longer, more and more foetal membranes appearing after each pain.

The detached chorion, also leaving the vulva, has a characteristic surface, with flat, round or oval, ragged, reddish-brown spot, 4 to 7 or 8 to 12 cm. in size. These are the foetal placentæ. The pendulous piece increases in length and thickness; finally the whole mass drops when the union between the last foetal and maternal placenta is severed.

As soon as the after-birth has been expelled, a limited amount of uterine milk, mixed with blood, mucus and foetal liquor, which had remained between the envelopes, is discharged.

Expulsion of the placenta of the cow takes place four to six hours after parturition. It may happen that expulsion occurs earlier, or is retarded, or the foetal membranes are retained in the uterus. Here they may cause various disturbances, with which we shall acquaint ourselves later.

The post-partum or after-pains concerned in the expulsion of the placenta are not always of the same intensity. The weaker they are the slower the cotyledon becomes anæmic and the slower is the separation of the foetal from the maternal placentæ. When the uterus is greatly dilated, as in dropsy of the foetal membranes (Hydramnios, Hydrallantois), twins or an oversized foetus, the action of the uterine muscle is weak, and detachment of the placenta may take a long time. In many instances feeble after-pains are assisted by the auxiliary abdominal muscles. When this occurs danger of an inversion of the uterus is present. A limited amount of aid by the

abdominal muscles during the immediate post-partum stage is physiological. A slanting position of the cow often induces violent after-pains. This should be avoided. The care which the animal requires in this stage confines itself to see that she lies horizontally, that neighboring animals do not step upon, tear or devour the placenta. The latter may give rise to serious indigestion. This is occasionally seen in cows at pasture.

The expelled placenta must not remain in the manure behind the cow, but should be removed promptly and destroyed outside the stable. The udder, tail and hind legs are cleansed with soap and water and then rubbed dry. The cow should be watched in the interval between parturition and post-partum period, in order to care for or render assistance when disturbances manifest themselves.

## II.—LOCHIA.

By *lochia* is understood a uterine discharge continuing for several days after expulsion of the foetal membranes. It is inconsiderable in the cow and cannot be compared with a lochial flow or *fluxus lochialis*.

The lochia are a chocolate colored or only faintly colored fluid, consisting mainly of uterine milk, and contain also uterine epithelium, leucocytes and fat.

As long as the os uteri remains open the discharge may be evacuated, but when the os is closed it may be resorbed provided it is aseptic; but it may give rise to serious disturbances when forming a favorable medium for developing pathogenic organisms.

In the cow this discharge is characterized by agglutination of the long hairs on the vulva, by the muco-sanguinous matter at the inferior commissure, the tail and about the vulva. In the first few days after labor the lochia are of dark color, to become lighter and finally white and slimy. Physiologically, the excretion of the lochia does not require more than eight days.

It is of less importance in the cow than in carnivora, as detachment of the placenta in the latter means injury to the

uterus, since the maternal placenta is also expelled. Nevertheless, the views as regards the importance of lochia are divided.

Its suppression, some thought, caused in the mare, laminitis, articular rheumatism (Deneubourg), also metritis, peritonitis and parturient paralysis (Charlier). Later these views were not accepted, and but little importance was attached to lochia. In fact, they are only an excretion, which, having become superfluous after parturition in consequence of the process of involution, is removed.

We know, at the same time, that the lochia, as far as their composition is concerned, are an excellent medium for micro organisms. When no exploration is made and parturition runs a normal course, the uterine secretion is free from germs. Some may be found in the vagina and possibly in the cervix uteri. The bacteria are principally streptococci, of limited virulence. Whenever these organisms enter the lochia, rapid multiplication and increase in virulence occurs, especially when bits of decomposing tissue are in the lochia, since putrefactive bacteria may make the medium especially adapted for the development of streptococci.

Lochia play an important role in the ætiology of puerperal septicæmia. Schmidt-Mülheim thinks that by chemical changes of the lochia, with exclusion of air, a poisonous agent may be formed, resembling sausage poison, and by its resorption into the circulation certain phenomena are produced, to which the name of "parturient paralysis" has been given.

### III.—REGRESSIVE CHANGES OF THE UTERUS.

After expulsion of the foetal membranes the uterine lumen is already materially decreased. The cervix uteri, while contracted, still permits the passage of the uterus to continue without being especially noticeable; they effect continuously a decrease in the size of the organ. Two days after birth the cervix is still sufficiently dilated to let two fingers enter the uterus, but after four or five days this cannot be done any more. It also happens that after expulsion of the after-birth the

uterus contracts but little and slowly. Then the lochia are not evacuated, but accumulate in the uterus. This state is termed *inertia uteri*, or uterine sluggishness. Severe hemorrhages, as in man, do not happen in this state. Since the cervix uteri remains open on account of the wanting uterine contractions, a factor quite favorable to the chemical change of the liquid is present.

The weight of the uterus always decreases during the process of involution. Baumeister and Rueff state that the uterus of a medium sized cow immediately after parturition weighs 6 to 7 kg., later 500 to 600 g. All three layers of the uterus lose in weight, especially the muscularis and mucosa. Let us now consider some points a little closer: First, the puerperal involution of the uterine muscle. Since the middle of this century examinations in regard to the involution of the uterine muscles have been made. Kilian mentions as the predominating theory of his time, that the muscular fibres are compressed by the after pains, and that the liquid thus squeezed out is partly removed by the lochia and partly resorbed.

According to Kölliker, the process of involution in the beginning of gestation depends on hypertrophy and hyperplasia of the muscles, but after the fifth month of pregnancy hypertrophy only persists; he says: "After parturition the fibrillar cells of the gravid uterus rapidly decrease in length, at least I found them three weeks after delivery only about .03 mm. long, and filled with many larger and smaller fat drops arranged in rows."

Kilian experimented a good deal with rabbits and guinea-pigs. He found that all the old fibres perish and become replaced by newly formed cells. One might therefore rather speak of a regeneration or restitution than involution.

Heschl agrees with Kilian on the main points, but he thinks that the development of fibres only begins in the fourth week of the puerperal state. After two months he found the whole uterus regenerated. He is further of the opinion that puerperal processes, chronic diseases and anomalies in the shape of the uterus, have none or but little influence upon its involution.

but certainly upon its reconstruction, namely, in the shape of fatty degeneration of the newly formed cells.

Kölliker states in his microscopical anatomy that the muscle cells, which during gestation have become seven to eleven times longer and two to five times wider, are reduced to their original length three weeks later. As a cause of this he mentions atrophy plus fatty infiltration of the contractile elements; possibly certain fibres are completely resorbed. His observations, confined to man, did not reveal any regeneration, and he can see no reason why this should not hold good in the uterus of lower animals.

Balin closely studied the changes in blood vessels of the uterine muscle during the puerperal state. The arteries showed cell proliferation of the intima both in the direction of the lumen and intima, this process leading to obliteration and fatty metamorphosis of the media. The thickening of the intima of the larger veins does not result in obliteration, but does so in the smaller veins; these undergo fatty degeneration.

C. W. Broers (Holland), from whom the above is taken, studied the process of involution on the rabbit and came to the following conclusions:

The decrease in volume of the uterine muscle in the beginning of the puerperal state depends on the exit of glycogen from the hypertrophic muscular fibres, where it was present during birth, also on the resorption of the fluid of the oedematous inter-muscular connective tissue. The glycogen is probably carried off by the lymph vessels, after undergoing chemical change. The blood vessels lose either entirely or partly the blood, while the entrance of glycogen into the muscularis of the arteries leads to a decrease of this hypertrophied tissue.

The entrance of glycogen, during the first hours following parturition, is the only cause of the progressive atrophy of the muscular elements, but is joined at the end of the first day by another process.

At this time some muscle-cells show droplets of fat. In the following days the latter process predominates, the smaller and larger drops of fat become confluent, leave the cells and

for some time remain in the intermuscular connective tissue. On the fifth day, decrease in the volume of the muscle-cells only depends on the emigration of the fat.

After one and one-half weeks the volume of the muscle fibres had decreased until their average size was that of a normal uterus.

The above process never leads to destruction of muscular fibres.

The fat which had formed in the muscular fibres and mucosa and deposited in the inter-muscular connective tissue, is carried from here by the lymph and vascular channels; even after five weeks some fat is still found.

The same rotation manifested in the atrophy of the uterine muscle also takes place in the arterial muscularis. The lumen becomes greatly lessened, due to proliferation of the intima, and sometimes becomes obliterated.

The uterine mucosa after parturition also suffers considerable changes. The cotyledons become smaller, lose their peduncular identity and undergo regressive fatty metamorphosis. Fourteen days later cotyledons proper do not exist. After three weeks the mucosa has returned to its original state. Puerperal processes—for instance, septic metritis—do not influence the regressive changes of the cotyledons; that is, they do not retard them.

## C.—ABNORMAL PREGNANCY.

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### I.

#### DISEASES AND ACCIDENTS OF PREGNANCY.

##### 1.—Circulatory Disturbances.

Already when dealing with pregnancy it was mentioned that the total amount of blood in the mother increases during development of the young. In consequence of it, an active dilatation or eccentric hypertrophy of the left heart takes place. This hypertrophy develops so gradually that no disturbances arise in spite of the greater efforts which the heart must make to propel the increased amount of blood over the body. The annually occurring pregnancy of the cow, desirable from an economic standpoint, conception taking place two or three months after the stage of involution, often leads to a permanent hypertrophy of the left heart. In old milch cows one frequently meets with hypertrophy of the left heart, this condition never having caused any disturbances during life.

In the pregnant animal, swelling of the udder begins at the eighth month of gestation. This occurs a little sooner in cows which have calved frequently and have been dry for quite some time. In primiparae the swelling of the udder begins four to six weeks before parturition and increases up to birth. Many breeders look upon this tumefaction as a favorable indication for milk production. The swelling confines itself at first mainly to the posterior quarters, but may extend later to the anterior half of the udder.

This swelling before birth is physiological; it may extend to the vulva and anteriorly to the umbilicus.

The tumefaction of the vulva, often so intense that the skin becomes glistening and tense, is not caused by a disturbed

return flow of the blood—that is, venous stasis—but is due to an active hyperæmia. This hyperæmia, characterized by its redness, swelling, heat and increased sensibility, extends beyond the vagina.

The swelling of the udder and surroundings must be attributed to the same causes. But it happens that this so-called oedema increases to an extent sufficient to worry the owner. The oedema extends at times backwards and up to the vulva; the perineal region is swollen, its skin tight, the vulva enlarged and the skin of the labiæ glistening.

The udder has reached such dimensions that the skin is tense and the teats barely project beyond the swollen udder; in other cases the teats are full and milk runs from them. All these phenomena only put in their appearance at the end of pregnancy, and become fully developed only a few days before parturition.

The swelling may extend along the umbilicus up to the fore legs. In primiparæ this oedema occasionally becomes so prominent, that the inferior abdominal wall hangs down like a pillow from the udder to the dewlap. Such an extensive tumefaction probably depends also on a disturbed circulation—that is, venous stasis.

The blood of the udder of the cow returns by two channels. One part returns through the external mammary vein, while the balance flows off through a branch of the external pubic vein, which runs upwards from the posterior quarter into the obturator and internal pubic vein.

The venous blood carried off in the above named manner therefore has not favorable conditions for its course; consequently the slightest disturbance may retard the return flow.

On account of the swelling of the vulva and the increased amount of blood at the vagina, a considerable accumulation of blood also takes place in the venous network of the vagina; this venous network also empties into the internal pubic vein. In consequence of the stasis experienced by the blood of the ascending branch of the external pubic vein, a passive hyperæmia takes place in its tributaries.

Only when the swelling reaches such a degree as to disturb the general health of the cow, or rising or lying down becomes difficult, treatment is indicated. As a rule, expectant treatment is all that is necessary, the oedema disappearing soon after birth.

The decrease of the swelling of the vulva and vagina in the first few days following parturition depends partly on the cessation of the reflex hyperæmia, partly on the fact that the venous blood now flows off more readily by the internal pubic vein.

Prognosis is usually favorable.

The treatment primarily is directed to equalize the circulation. For this purpose exercise is to be recommended, influencing beneficially the venous circulation. In the winter, of course, it is often difficult to exercise a pregnant cow; but then it does not take much room for that purpose. In good weather, such an animal ought to get an hour's exercise twice daily.

When the milk runs out of the teats a few days before parturition—quite often the case in heavy milkers—the udder ought to be emptied two or three times daily. Many owners believe erroneously that the general health of the animal is unfavorably influenced by this, while, on the contrary, milking is beneficial. It lessens tension and diminishes fatigue the result of a long continued standing posture; as a consequence, the cow can lie down.

Since this treatment is almost invariably sufficient, therapeutics may confine itself to it. Of course it is understood that rational feeding during pregnancy is the best means to prevent enormous swelling, as seen in animals of a lymphatic disposition.

I again emphasize, that swelling of the udder, vulva and its neighborhood is physiological, and that only extraordinary swellings, influencing unfavorably the other functions of the animal, are pathological and demand treatment.

It has been recommended to treat this oedematous condition by massage and stimulating embrocations, as spirits of

camphor, ammoniacal liniments, etc. Although this is not detrimental—in fact, may slightly stimulate circulation—this treatment may be safely omitted, unless it serves to treat the owner rather than the patient.

[While liniments may be of doubtful value, the following composition, applied three to four times the first day and once the second day, has always given me excellent results: Ol. terebinthinæ, 90; spts. camphoræ, 120; aquæ, 240; shake.—W.]

Scarifications are not advisable, as they may lead to infection, especially when animals lie upon earth floors—only too often the case. Here pathogenic organisms may exert their detrimental influence when the proper occasion offers itself.

Formerly, when this condition was wrongly interpreted as a hydramic state, the internal administration of diuretics was employed; their use may be safely omitted, as it is apt to produce injury. Advanced pregnancy anyway contra-indicates their administration. Therapeutics is therefore better confined to advise against certain methods of treatment than to actively interfere. Experience teaches that but little medication is required in these cases.

## 2.—Inversion of the Vagina During Pregnancy.

*Definition.*—Prolapsus of the vagina consists of an inversion of the superior and lateral vaginal walls, so that the mucosa is visible between the labiæ or even the whole inverted vagina hangs from the vulva. When the inverted vagina does not extend beyond the vulva, it is termed inversion of the vagina (*inversio vaginæ*). When it has passed beyond the lips of the vulva, it is called inversion and prolapsus of the vagina (*inversio et prolapsus vaginæ*). An inversion which repeats itself during pregnancy is known as *habitual prolapsus vaginæ*.

*Topographical Anatomy.*—The vagina lies between the rectum and bladder. It is fixed by the perineal muscles, the deep perineal fascia, further urethra, vesico-vaginal and recto-vaginal excavation.

Anteriorly it is held by the vaginal portion of the uterus and is there held in position by the cervix uteri. The superior wall consists of mucosa, muscularis and, partly, adventitia. At the abdominal cavity the adventitia is replaced by a serous membrane—that is, the peritoneum as part of the recto-vaginal excavation. The inferior wall, up to the angle formed by it and the urethra, is also covered by a serous layer. The urethra in the cow is held in place by the very strong pubo-vesical ligament, composed of strong elastic fibrous fibres. This ligament also indirectly fixes the inferior vaginal wall. The upper and lateral walls of the vagina, therefore, are more easily displaced than the lower one.

*Etiology.*—The causes inducing this inversion are partly predisposing, partly direct. As an occasional cause, we must mention relaxation of those organs which fix the vagina, as the deep perineal fascia, perineal muscles, the broad pelvic ligaments and mesometrium. This relaxation occurs frequently at the end of gestation, when the pelvic tissues become infiltrated in consequence of increased blood pressure. Predisposed cows are lymphatic animals which gave a great deal of milk while pregnant, and emaciated ones. Experience teaches that cows advanced in gestation easily get a prolapsus, when subjected to long drives and railroad travel. Prolapsus *vaginae* is also caused by standing cows on floors inclined too much to the rear. It is generally known that when the posterior extremities of the animal during gestation are kept lower behind than in front, inversion of the vagina often occurs. The continuous pressure exerted upon the superior wall of the vagina, the abdominal viscera in such a position forces it to turn its concave side toward the abdominal cavity. The gravid uterus also presses upon the superior vaginal walls, pushing this one backwards. The greater this pressure, especially toward the end of gestation, the more is the vagina displaced toward the vulva. This factor already belongs to the domain of direct causes. When the intestines enter the recto-vaginal excavation,—always the case in this sloping position of the hind-quarters,—the uterus also becomes displaced. The weight of

the intestines widens this originally small excavation. As a consequence, the superior and lateral walls of the vagina are forced downward and backward, thus lessening the lumen of the vagina. The continuous pressure displaces the vaginal walls more and more, until it reaches the vulva or extends beyond it. When limited inversion confines itself to the upper wall, when more extensive to the upper and lateral walls, and when complete, it also includes the floor of the vagina lying in front of the meatus urinarius, the vaginal portion of the uterus then becoming visible between the labiæ.

*Symptoms.*—*Prolapsus vaginæ* is mostly seen in cows which have already calved several times; it is frequently seen in old cows, but also cows which only calved once may show an inverted vagina toward the end of the second pregnancy. It is occasionally noticed in heifers, where a previous dystokia led to considerable destruction of the vagina and its surroundings.

The owner usually notices this affection when the inversion is already quite considerable. More limited degrees, where the superior wall is pushed backward and into the lumen of the vagina, and which is not visible from without, escape his observation. As the prolapsus progresses, the inverted parts appear as a rose-colored tumor, separating the labiæ and only noticeable when the animal is in the recumbent position.

When the cow rises, the tumor mostly disappears, as the abdominal pressure ceases and the upper, respectively, lateral, walls of the vagina return to their original position.

In cases of complete inversion and where the cow lies very low behind, the prolapsus vagina extends beyond the vulva. The tumor, which is now visible outside the vagina, is as large as the head of a child or man; its surface is formed by the mucosa of the vagina. A prolapsus of head size may disappear when the cow gets up, but appears as soon as she lies down. A large prolapsus, and especially when the inverted portion is exposed some time to the air, and the mucosa inflamed, spontaneous reposition does not take place when the cow rises.

In such cases the services of the veterinarian are mostly wanted. On his arrival the inversion is often already several days old, the mucosa swollen, at times torn and soiled by faecal matter. The animal at the same time shows but little disturbance of its general health; for this reason the owner waited so long before he called the veterinarian.

The patient feeds well, ruminates; pulse, respiration and temperature are normal; but in receiving the history one is informed that she defecates often, a little at a time, and that micturition is difficult. The animal strains a good deal, accompanied by the passage of small amounts of urine. The latter is easily explained. The pressure exerted by the inverted vagina upon the urethra interferes with the flow of urine. When such a patient is examined by gliding the hand around the inverted part, one notices that the hand cannot advance beyond the upper commissure of the vulva, while it enters the inferior commissure and may advance as far as the urethral opening. Such an exploration usually causes the animal to strain.

*Differential Diagnosis.*—When the symptoms given so far are carefully considered, this trouble is not easily mistaken for other disturbances. Nevertheless, it is possible to mistake prolapsus vaginalis for tumors of the vagina, retention cyst of the vulvo-vaginal glands (glands of Bartholine), with inversion of the urinary bladder.

Tumors are recognized by their greater consistency and base, which can be felt. The retention cyst of the vulvo-vaginal gland, which fluctuates, lies laterally on the floor of the vestibule. Prolapsus of the urinary bladder (*inversio vesicæ*) is characterized by the regular dropping of urine, the finger cannot detect the meatus urinarius, and the superior and lateral walls of the vagina are in place. The diagnosis therefore is not difficult.

*Prognosis.*—Prolapsus in the cow is not dangerous in itself, provided it is properly treated. Even when the owner neglects a complete inversion, quite some time must pass before the animal is seriously influenced. Cases are known where a prolapsus as large as a head, hanging from the vulva for three

weeks, with necrosis of the whole mucosa, did not produce any constitutional derangement.

A cow suffering with prolapsus vaginae for three weeks was to be slaughtered. She was not only perfectly well, but the owner also stated that her general condition within the last few weeks had not suffered any. His anxiety was not caused by the prolapsus itself, but by the morbid changes taking place in the inverted portion; as a result of necrosis, it had become black. After slaughter the cow proved to be with calf since six months. This shows how well a cow may endure such an inversion.

With regard to a complete recovery, prognosis is not always favorable. When the prolapsus disappears immediately after parturition, many think that complete recovery has taken place. As soon as direct causes present themselves again—for instance, pressure from distended intestines, well advanced pregnancy—involution puts in its appearance. It is understood that a predisposing factor, as mentioned in the discussion of the aetiology, is present. At the same time, we must admit that by proper food and nursing a good deal can be done toward prevention in the future.

*Therapeutics.*—The presence of a prolapsus vaginae, which does not disappear spontaneously when the cow rises, calls for its reposition. Previously it must be cleansed thoroughly. The dirt, usually faeces, is washed off with clean water; the labiae, tail and thighs are cleansed with soap and warm water. While doing this, the animal is standing. Now the inverted vagina is treated with antiseptic agents, as 2 to 3 per cent. solution of creolin, 2 per cent. solution of carbolic acid or alum. The latter is to be recommended as a cheap and efficient astringent. Reposition is next practiced. One usually succeeds by pressing in an upward and forward direction with the whole hand upon the inverted parts. Should it not suffice, it is well to change the position of the animal by raising the hind-legs higher than the fore-legs and thus removing the pressure exerted upon the pelvic organs by the abdominal viscera. The prolapsus is now pushed forward by placing one hand on each side of it. It might be well to cover the hands with a clean

cloth in order to avoid injury to the parts. The pressure, which must be gentle, even and continuous, must be exerted with the whole hand. In this manner the vaginal walls can usually be replaced.

Following reposition, the hand is introduced into the vagina; wherever necessary, folds are smoothed and the anterior position of the inferior wall is slowly and gently replaced. An extensive inversion, especially when exposed to the air for some time, cannot always be reduced in this manner. Here another method is employed. The animal is prepared as before, but the prolapsed portion should be bathed with a 2 per cent. alum solution for ten to fifteen minutes. Now a bandage, 20 cm. wide and 1.5 m. long, moistened with the alum solution, is slowly and tightly wound around the inverted vagina. Reduction of the prolapsus is effected by pushing in an upward and forward direction with both hands.

Continuous straining makes reposition very difficult. Internal medication is not required, as it may be limited by simple means. Already elevation of the hindquarters diminishes straining; it is decreased still more by pinching the back of the patient while reducing the parts. Walking the animal slowly and reducing the prolapsus at the same time, if possible, often gives good results. (Very bad cases can usually be managed nicely after giving them chloral hydrate, 60; tinct. opii., 30.—W.)

In order to prevent excessive straining after reposition of the prolapsus, gentle exercise is useful.

It does not suffice to reduce the inversion; its eventual recurrence must also be prevented.

A displacement of the vaginal walls only could be prevented by introducing a pessary, by a rubber pouch or pig's bladder distended with air and held in place by suturing the lips of the vulva. Theoretically, this is very nice, but practice teaches that the application of such means is useless, as the patients strain violently after the introduction of the pessary, this making the cure worse than the evil. Therefore, this method is best left alone, and other means quite efficient in

practice are to be employed to prevent recurrence of the inversion. The following methods are indicated:

The bandages, fully discussed at prolapsus uteri, are of little use here, as they can only be employed temporarily. The simplest operation consists of suturing the lips of the vulva (labial suture). It may be done with tape, 1 to  $1\frac{1}{2}$  cm. wide. The first stitch is put in directly below the superior commissure of the vulva, the second one half way down the labiæ. When three sutures are put in, the second and third suture are placed at an equal distance between the first suture and lower commissure, so that the space between the upper stitch and inferior angle of the vulva is divided into three equal parts by the two lower stitches. In order to prevent tearing, the stitches are placed 3 to 4 cm. from the lips and run through the skin, subcutis, muscularis, submucosa and mucosa. In the other lip the stitches perforate horizontally the same layers, only in an opposite direction. It is important to place the first stitch sufficiently high to prevent prolapsus of the upper wall of the vagina. Two sutures are mostly sufficient. Since these stitches usually have to remain until parturition, ordinary tape does not suffice, as it may tear, leather strings having the same disadvantage. The so-called labial gate is certainly the best agent. It consists of two or three heated copper needles, 12 to 14 cm. long, each with an eye and point. After the needles have been pushed through both lips, the point is broken off by filing a little groove at the point of fracture. Then an eye similar to the one on the other side

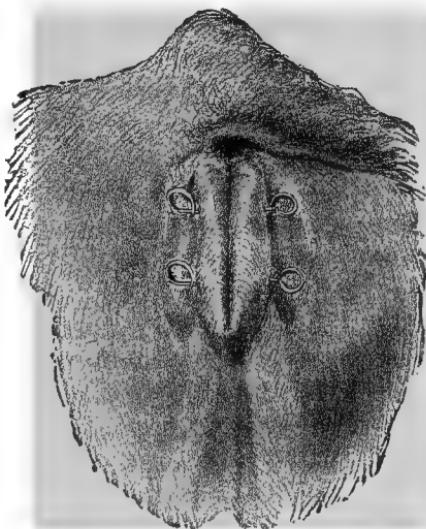


Fig. 14.—The Gate, labial suture.

is made there with a forceps. Two such needles suffice. To prevent tearing, it might be well to place a leather washer between the skin and eye of the needle. The suture stays well, does not tear out and discommodes the animal but little. The above drawing (Fig. 14) explains such a suture.

Deneubourg's method consists of perforating the labiæ with two thin sticks. Each stick has a cross-piece firmly united to it on one end, a detachable sharp point being on the other end. After perforating both labiæ, the sharp point is unscrewed and a cross-piece of the same shape as those on the other end is fastened by means of a screw.



Fig. 15.—Sauberg's Labial Ring.

The application of this instrument is easy and simple, but the copper suture is cheaper and can be readily procured. Sauberg constructed a ring, termed "Sauberg's Vaginal Ring." It is 8 mm. wide and 2 mm. thick, 17 cm. long, and made of copper. Its blunt part shows near its end a little hook 4 mm. long; the other and pointed extremity has a little hole of 2 mm. diameter, 2 cm. from its sharp point. Before its introduction the ring is spread out. Now the labiæ are perforated at a proper distance from the free border, both ends of the ring are bent toward each other, and the hook is pressed into the little hole and may be flattened with a pair of pincers, practically riveting the two ends.

Van Leeuwen (Holland) describes a modification for the "labial ringing": "I first hobble the animal's hind legs and place an assistant on each side of the cow to prevent her from moving about. Now I perforate both labiæ of the vulva with an ordinary seton needle and pull a piece of rubber tubing through the holes. The latter is done by attaching the gutta-percha tube to the seton needle and thus pulling it through the wounds, or by grasping the tubing with an artery forceps pushed through the wound. After the tube has perforated both labiæ, a figure 8 knot, close to the vulva but still allowing a little vantage, is made. To further secure both knots they may be tied by string.

Two such sutures, requiring about 1 m. guttapercha tubing, are sufficient. The great advantage of this method lies in the point that such a suture may remain for months, even years, without tearing out, due to the softness and elasticity of its material.

Wollenmann, at Eschenbach, constructed an apparatus consisting of a sharp needle, at the blunt end of which a little hook is found. The needle is passed through the labiæ; into the hook at its blunt end he hangs a brass ribbon which has an eye at the one end and a little hook at the opposite end. The brass ribbon is pulled through the lips by means of the needle, and by bending its two ends toward each other it is fastened by putting the little hook into the eye.

Should we see during reposition that the vaginal mucous membrane is injured or shows superficial necrosis, on account of prolonged exposure to the air, treatment is imperative. For this purpose the vagina is irrigated twice daily for three to five minutes with a warm 2 per cent. alum solution. The solution must not be cold, as it may induce the animal to strain.

### **3.—Paralysis of Gestation, Paraplegia ante Partum.**

This name comprises many disturbances and derangements of the most varied kind, so that we cannot speak of a definite clinical entity. It is given this name, as the closest examination does not result in an exact diagnosis.

*Definition.*—This disease occurs occasionally in cows which have calved repeatedly, more rarely in heifers, several days or weeks before parturition, and is characterized by a more or less complete paralysis of the hindquarters, so that the animal is unable to rise.

*Aetiology.*—The following disturbances and diseases, in which the cow cannot rise, must be distinguished from paraplegia *ante partum*.

1. Cows well advanced in pregnancy become cast by lying too close to the feeding trough or partition. Such animals make vain attempts, since they cannot extend head and neck sufficiently to get upon the knees. We must think of it while conducting an examination and pull the patient back in order to furnish her more favorable conditions. It also happens that the cow is so utterly exhausted after making persistent and fruitless efforts to rise, that a few hours of rest are necessary before she will get up.

2. Great debility of a pregnant cow. This may be caused by gestation, hydrallantois, ascites, but also from insufficient nutriment. It can hardly be difficult to recognize such states; at the same time I refer to the different chapters dealing with those subjects.

3. Fractures, luxations and contusions may occur in pregnant animals and make it impossible for them to rise. A thorough examination, where we must not omit to roll the patient over in order to inspect all parts, may establish the presence of such lesions.

4. Osteomalacia. Cows with osteomalacia, which has become worse during pregnancy, may remain down before birth, without suffering with fractures (St. Cyr and Violet). The course of the disease, the knowledge of the aetiological moments and their effects upon other animals of the same stable, will throw light upon the case. But there are patients not suffering with any of the above named disturbances or diseases, and yet paraplegia *ante partum* is present. The disease only occurs a few days before parturition and is caused by an *infiltration of the lumbar and pelvic muscles*. Although this infil-

tration *per se* does not entirely explain this paralysis, other auxiliary causes, as voluminous but little nutritious food, assists in rendering it difficult or even impossible for the cow to rise.

*Symptoms.*—The disease sets in two to five days, at times earlier, even fourteen days, before parturition. These cases occurring several weeks before birth depend probably on other causes. At times certain premonitory symptoms, as weakness of the posterior extremities, paddling, precede paraplegia; in other cases the patient goes down without previously showing any symptoms suggestive of paralysis. The general state of health is good, the cow eats well, ruminates, defæcation and micturition are normal, she lies in a normal position with the head erect, and cheerful expression of the eye; in short, all that is wrong is her inability to rise.

When we attempt to make her get up, she may weight the knees and rise sufficiently behind to rest on the fetlocks, but that is her limit. External examination, as well as rectal exploration, does not detect any abnormality. Sensibility of the hind legs is also normal. The animal can move the hind legs, elevate and extend them, may even roll over from one side to the other. In the latter instance we may expect her to get up soon by herself.

*Course.*—Experience teaches that the patients mostly remain in the recumbent position until parturition. When it occurs without extraordinary efforts on the part of the animal, or especial disturbances during extraction, the animal mostly rises soon afterward on the same day or on the following. At first some weakness behind persists, but this disappears soon.

When, however, the cow becomes paralyzed ten to fourteen days before parturition, decubitus and its sequels—even a fatal termination—soon set in, unless she is nursed most carefully. With proper care such patients do well up to parturition and rise soon afterwards. It is quite natural that recovery ensues as soon as the infiltration of the pelvic muscles and the disturbed circulation after evacuation of the uterus cease, and the maternal organs again are properly nourished. Paraplegia

ante partum may terminate fatally when of long standing, as a case reported by Vermast teaches. Vermast (Holland) examined a cow which went down twenty-two days before parturition, without showing any other phenomena. The owner thought she had "wolf in the tail," that is, a softening of two or three last coccygeal vertebræ, a condition which is seen almost in every cow well advanced in pregnancy, and of course cannot be the cause of paraplegia. After the calf was delivered, her condition became worse and worse, so that she had to be killed finally. Post-mortem examination revealed the following: Abscesses in the right lung; the quadratus lumborum, ilio psoas and psoas parvus were very pale and showed serous infiltration; serum had accumulated between the dura mater spinalis and arachnoidea; the spinal cord of the lumbar region was somewhat softened and the gluteal muscles atrophied.

*Therapeutics.*—The treatment of such patients will be mainly a dietetic one. They are given food which is not voluminous but easily digested and nutritious. They should receive a horizontal, thick straw bed, the hindquarters must not be lower than the fore legs, as otherwise prolapsus vaginae might appear. To prevent bed sores, the cow must be turned over twice daily. In order to do this, the legs are flexed against the body of the cow, three men are stationed on the opposite side against her withers, back and loins, to roll her over her legs. It is strictly to be avoided to roll her over her back. Many owners are not satisfied with such advice alone; they demand medications. The latter is not necessary, but when it contributes to ease the owner and obliges him to execute the other suggestions, it is well to prescribe, for instance, a liniment to be applied several times daily to back and spine, rubbing of the legs with spirits of camphor, and massage with a straw wisp may influence the circulation favorably. Sometimes the question is raised whether such a patient should not be placed upon her legs.

When the efforts of the cow indicate that she can rise with some assistance, two or three men properly placed and directed may assist her to do so. To raise a cow with pulleys, or to

place her in slings with the whole weight resting upon the belly-band, is ruinous. A cow when once up must stand upon her own legs, but may of course be slightly supported.

In order to assist a cow to rise, Von Johne's method is practicable. A strong and long rope is placed upon the ground and all around the cow, so that it lies in front under the sternum and behind under the ischial tuberosities. The rope is tightened and its ends tied together. At each side of the cow three persons are placed, who grasp the rope with the hands and raise the cow when the word is given. The rope does not slip, as it rests against the sternum and ischial tuberosities. When necessary, both sides of the rope may be united by cross ropes behind the elbow under the breast. Experience teaches us that when a paralyzed patient is carried to the pasture (provided the weather permits and grass is plentiful), the danger of decubitus is much less and the attempts at rising by the animal and assisted by the owner are much more successful.

It is advisable to put the cow upon her legs in the above manner, soon after parturition.

[In the treatment of ante-partum paralysis, artificial abortion is the most successful therapeutic agent. My colleague, Dr. T. F. Moyle, of Waterford, and myself tried it too many times to leave any doubt. Observe the following rule: When the cow is still able to rise and wabble, open the os uteri—(take your time)—and with any instrument (we use the repeller) perforate the foetal membranes, and leave her alone. When the cow is down and unable to rise, open the os uteri, enter the foetal membranes and extract the foetus. We never failed to see the cow rise and do well within twenty-four hours after the removal of the young.—W.]

I shall briefly consider the complications of this ailment. First, prolapsus vaginæ, which may become very troublesome. When left to itself, it becomes eventually so great that the vaginal portion of the uterus appears between the labia. Attempts to reduce it are only then successful, where the hindquarters are elevated above the foreparts; only then is suturing of the vulva possible, as otherwise the stitches tear out in a few days.

Although inversion is a serious complication, one must not despair too soon. When reposition is successful and lasts until parturition, everything usually ends well, but care must be taken that the posterior extremities are kept in an elevated condition during parturition.

Digestive disturbances are often seen in such patients. Its characteristic symptoms are : Appetite is lessened, rumination ceases, defæcation indolent. Fæces are hard and are passed in balls. Tympanites may be present. Here dietetic treatment is the main thing. Nutritious, easily digested and not voluminous food is required. Hydrochloric acid, and, when necessary, a saline purge, should be administered. Quickly arising tympanites is corrected by puncturing the rumen. When cows, advanced in pregnancy, rest upon the left side for some time, the functions of the rumen are interfered with by the pressure from the gravid uterus. Belching is prevented and tympanites follows. The treatment consists of rolling the animal upon the right side or by placing her upon the knees and flexed hocks in a straight position. Eructation immediately follows and tympanites subsides. This exceedingly simple and rational method is used with much success by many practitioners. When discussing embryotomy and prolapsus uteri, I shall take up tympanites, following improper positions.

#### 4.—**Hernia of the Uterus, Hysterocele.**

When, in ventral hernia, the gravid uterus with the foetus forms the contents of the hernia, it is spoken of as *hysterocele*, or *hernia uteri*. It is hardly reasonable that the uterus would pass through a hernial orifice in the unimpregnated state ; the manner in which the mesometrium holds the body and horns of the uterus in place, makes this almost impossible. But when the uterus is gravid and a part of the impregnated cornu extends beyond the anterior border of the mesometrium, the pregnant uterus may pass through a rent in the abdominal walls and form the contents of a hernial sac.

Should rupture of the abdominal muscles be of recent date, the hernia enlarges as soon as the pregnant uterus sinks through the orifice. It sometimes happens in pregnant cows, that solution of continuity of the abdominal muscles only occurs toward the end of gestation, as a result of the great weight and enormous distention of the abdominal muscles ; then a large rupture appears, containing the gravid uterus.

Many such cases have been published. V. Lindenberg reports one due to an hydrallantois. The cause was the extraordinary distention of the abdomen. The cow could rise with difficulty, as the belly, which before its rupture was so greatly distended that the cow could barely stand in the stall, now almost touched the ground. The udder was pushed forward to the middle of the belly. Post mortem examination of the cow showed that the pubic insertion of the rectus abdominis had been torn off.

Some years ago I examined a cow which suddenly showed a large ventral hernia. I found that the rectus abdominis had torn loose from the pelvis. The teats were only 20 cm. from the ground. About eight days later the cow calved, and by means of powerful extraction twins were born. Although manual removal of the afterbirth became necessary, which was only partly possible, parturition ran a normal course. The extent of the rupture remained ; a few days later the cow was slaughtered.

*Ætiology.*—Anything causing an excessive distention of the abdominal walls is a predisposing factor of hernia. As such we may mention : Hydrallantois and multiple pregnancy. A serous infiltration on the abdominal muscles may also predispose rupture of muscular and tendinous fibres. Rupture of the rectus abdominis is usually the result of traumatism, when the above mentioned states exert their detrimental influences.

*Symptoms.*—The hernia may occur in various places. The abdominal muscles usually tear in the linea alba, near the pubis, or in the right lower abdominal region. Then the hernial sac and contents are visible.

Palpation at times reveals parts of the foetus. When the rupture occurs in the right lower abdominal region—that is, alongside the linea alba—the udder may remain in situ, and to the right of it a hernia of enormous dimensions (Fricker). When the right abdominal muscle tears off the pelvis, the belly and udder descend until the teats of the latter almost touch the ground.

*Prognosis.*—Prognosis with regard to hernia uteri is always unfavorable. When originating during pregnancy, danger arises that it enlarges as the foetus develops. The fact that it may



Fig. 16.—Uterine Hernia (Fricker).

become incarcerated and parturition difficult justly entitles us to make an unfavorable diagnosis.

*Therapeutics.*—There is practically no treatment when an extensive hernia appears toward the end of pregnancy. The owner rather waits for parturition, provided it is to be expected shortly, and then slaughters the cow. In this way he may get a living calf. Only when the hernia interferes with parturition, can we think of rendering assistance. As the result of the displacement, the normal direction of the uterus is changed, a deviation commonly termed inferior obliquity or anteversio. Obstetrical therapeutics will be fully discussed under that head; I shall allude to it here only briefly. Labor pains in this con-

dition are only weak. The expulsive force is greatly diminished since now the auxiliary muscles are in abeyance, and therefore forcible extraction is called for. Besides that, reposition is made difficult, as certain parts of the foetus, on account of the great distance, are not accessible to the hand. Under these circumstances it is best to raise the belly of the cow with a covered board, or to put her into a dorsal position, to reach the foetus. The strongly dilated uterus frequently contracts but slowly after extraction, and as a consequence the foetal envelopes are retained. This must be considered and the treatment shaped accordingly. After parturition, intestines often enter the hernial sac, so that the hernia persists. When the right rectus abdominis is torn off, no recovery is possible.

### 5.—Abortion.

*Definition.*—The period of gestation of the cow is pretty well established. It is, on an average, 40 weeks. Expulsion of the foetus at that time is spoken of as natural parturition, or *partus maturus*. Expulsion before this time, provided the foetus is capable of living, is termed premature birth, or *partus prematurus*. When expelled at a time when insufficiently developed to live external to its mother, it is known as *abortion*, or *partus immaturus*.

Abortion therefore means expulsion of the young at an earlier period than premature birth; the latter can only occur in the cow after the thirty-second week of her period of gestation. As a rule, the word abortion is used to indicate a premature expulsion of the foetus, whether able to live outside the uterus or not.

In the further course of my discussion, I mean by abortion, premature expulsion of the foetus, no matter at what time it occurs.

None of our domestic animals are so frequently affected with this disease as the cow. The economic importance of this disease is great, especially when of an enzootic nature; but also when attacking the only cow of a smaller breeder the damage

to that party is considerable. As a result of abortion, the foetus is born either dead or reaches the external world in a worthless state; further, the production of milk is interfered with, and the total sum of milk of the coming period of lactation remains far below the normal quantity. The cow herself may also become diseased. Chronic and acute sequels often follow abortion, as retention of the afterbirth (*retentio secundinarum*), and, in consequence of it, emaciation, metritis, leucorrhœa and even a fatal pyæmia.

Abortion may confine itself to single cases here and there in one or more stables or herds. Among twenty or thirty cows, one or three to four cases appear. Under these circumstances, we speak of a sporadic abortion. When numerous cases manifest themselves so frequently in a stable or certain herd or locality, that natural parturition forms the exception and abortion the rule, one speaks of a stationary abortion. Stationary abortion in stables, herds or localities, when depending on an infection, is termed *infectious abortion*; when of an enzootic type, it is called *enzootic abortion*. As the definition shows, stationary abortion is not necessarily infectious. The causes of abortion may be the same for all animals—for instance, mouldy food. Just as little need an infectious abortion be stationary. It may confine itself to one or more stables; the latter is often observed.

#### I.—NON-INFECTIOUS ABORTION.

*Ætiology.*—Let us first raise the question, Why is abortion so common in the cow and rare in the balance of domestic animals? According to Schneidemühl, one of the most important causes of extensive abortion among milch cows lies without doubt in the faulty selection and care of the mother, being contrary to all laws of hygiene and rational breeding. As a matter of economic interest, the cow has been pushed to her physiological limits; a step further, and the great lacteal secretion induces disturbances, which leads to the question whether the greater gain in milk overbalances the acquired want of resistance, predisposing her to many diseases.

Early conception, often at an age of fourteen to fifteen months, in consequence of which the heifer bears a calf when two years old, accustoms the generative organs to an early function. The cow calves every year, and is expected to give plenty of milk even in a well-advanced stage of pregnancy. Even by feeding her heavily before the first parturition one attempts to increase future lactation.

Stockfleth is right when he says that in the cow keen competition exists between the uterus and the mammary glands, each doing their utmost to appropriate a part of the nutriment destined to develop the foetus and milk production. The weaker one succumbs, and if it be the uterus, abortion takes place.

The conditions enumerated above usually do not suffice to produce abortion. They can only be termed predisposing causes. Often insignificant causes, in themselves unable to produce abortion, do so when the above named conditions exist. The effects of all causes, infectious and non-infectious, to be mentioned separately, are much more powerful when the animal is predisposed. Direct causes are :

1. *Disturbances of the circulation*, influencing the circulatory territory of the gravid uterus. Circulatory disturbances may create labor pains. During ordinary parturition, the reflex hyperæmia from the ovaries produces uterine contractions (Frauck).

In that time when abortion takes place the uterus is much less sensitive than toward the end of the period of gestation. Venesection changes blood pressure when a good deal of blood is abstracted, and may produce abortion. For this reason, phlebotomy is not to be practiced on the pregnant animal. Psychic influences may effect a reflexory narrowing of the blood vessels, and thus somewhere else a collateral hyperæmia. Several instances are known where a cow suddenly frightened aborted.

Retarded venous circulation, as by pressure upon the posterior vena cava, the blood flowing through the uterus contains much carbon dioxide. The foetus itself is unfavorably

influenced, becomes asphyxiated, and may die. The cause has had a two-fold action ; on the one side, uterine contractions are produced ; on the other, death of the foetus by blood surcharged with carbon.

There are many disturbances which may follow when the blood is laden with carbon dioxide, as tympanites, chronic indigestion, pneumonia and many others. They may produce abortion. It is an old fact that certain food, liable to produce indigestion and other disturbances, may cause abortion ; for instance, great quantities of hot distillery slops, frozen turnips, clover. They act indirectly by causing circulatory disturbances, or directly (see 2).

2. *The presence of certain materials in the blood*, irritating the uterine nervous system, and in this manner possibly producing contractions. The detrimental influence of various food stuffs and many causes belong here.

(a) Mouldy food. Many fungi living upon the most common plants are accused of producing abortion. It is astonishing how well a cow stands mouldy hay. We often see the owner feed his cows hay which is full of dust, without bad effects. Only certain fungi exert an unfavorable influence upon the uterus. Ergot of rye (*secale cornutum*), when present in large quantities, is an ecbolic. In all probability other auxiliary causes must be present, as experiment shows that *secale cornutum* only produces contractions when labor pains are already present. The *Ustilago* family contains some fungi which act directly upon the uterus, as *Tilletia caries* of wheat, also *Ustilago carbo* and *Ustilago maidis*. Gerlach reports the following observation : Animals aborted the second and third day after eating the almost black chaff of rusty wheat, *Tilletia caries* ; in five weeks, ten cows aborted which had eaten more or less of such chaff.

According to Haselbach, eleven cows aborted in eight days after having been fed with corn covered with rust.

[Experience in this country and my own observations failed to prove the abortive properties of *Ustilago maidis*. —W.]

After a wet summer, when the hay is put up improperly, the conditions for the development of fungi is especially favorable. Many fungi in themselves are unable to produce abortion, but, by their action upon the albuminous bodies of the plant, certain substances producing abortion may be generated (Stockfleth).

It has been observed that cows aborted which were fed with beet molasses, a syrupy, dark-brown mass remaining behind after crystallization of the sugar. Schneidemühl thinks that the cause of this is found in the great amount of potassium and sodium salts. The feeding of clover which has been limed is also said to have produced abortion (Schneidemühl).

(b) Medicaments introduced into the circulation, which act especially upon involuntary muscles, which may produce a hyperæmia of the ovaries. Drugs of the first kind are: pilocarpine, eserine and creolin (Frohner). Their use is contraindicated in cows advanced in pregnancy. To the second group belong: cantharides, mustard seed and many acrid diuretics. Rueff states that 3 kg. of pulverized rape-cake may be given with impunity to a grown cow, but when mixed with water until sloppy may be injurious and cause abortion. According to J. Lehmann, as a result of the soaking, an etherial oil similar to mustard oil is developed. When such slops are exposed to the air for a while, they are no longer harmful, as the oil evaporates.

3. *All mechanical causes.* Long drives, railroad travel, especially when the animals are crowded, may produce abortion. Here it may be the result of mechanical insults, or follow disturbances as mentioned above (1 and 2).

Vaginal exploration in the cow is hardly connected with any danger. Of course a rough exploration may produce abortion, but otherwise it rarely follows. The same refers to cows which hook each other or when they fall (Beel).

With regard to abortion from metrorrhagia, see "Metrorrhagia."

4. *Previous abortion* is said to be prone to produce abortion in the succeeding period of pregnancy. Although it happens

that a cow aborts first in the seventh month, the following year in the eighth month, and the next year carries the calf the regular time, such cases are the exception in the non-infectious abortion. A premature expulsion occurring earlier than a preceding abortion is mostly due to a diseased placenta.

5. *The influence of the bull.* Kretschmar reports a case where all cows served by a certain bull aborted and retained the placenta. This bull came from a cow which aborted repeatedly and almost each time retained the afterbirth. Some think that heavy and large bulls might produce abortion. Stockfleth thinks that crossing of different breeds, especially with shorthorn bulls, is not accused without foundation as a cause of abortion.

*Symptoms.*—Abortion in the cow usually occurs between the fourth and seventh month of pregnancy. Expulsion of the foetus in the third and fourth or fifth months is usually not accompanied by any striking phenomena. Cows at pasture abort without knowledge of the owner. When happening in the stable or when watched at pasture, this premature abortion is recognized by various symptoms.

One of the first symptoms announcing abortion is the changed lacteal secretion. The quantity decreases and quality changes; the milk is more like colostrum. In heifers, this symptom of course is wanting, as they do not give any milk. The general state of health is but little, if any, changed; the cow eats well, ruminates; defæcation, micturition, pulse, temperature, are all normal. In some cases the animal is restless and the general health somewhat disturbed. When the foetus is dead some days, but not yet expelled on account of the insufficient dilatation, a bloody mucus flows from the vagina and feeble pains are noticeable now and then. At this period of pregnancy it is difficult to distinguish between weak uterine contractions and straining in consequence of retarded hard defæcation or difficult micturition.

The expulsion of the foetus and the period of oestrus always coincide (Franck); the hyperæmia of the genitals then present leads to uterine contractions. The connection of the

chorion and uterine mucosa is mostly obliterated, so that the foetal envelopes follow the birth of the calf—a very favorable factor, considering the process of involution about to follow.

The expulsion of a small foetus at this period of gestation as a rule offers no difficulties. A definite position does not exist at this time; the foetus is usually born in the anterior presentation. The process of involution now terminates quickly; for three or four days after parturition a little hemorrhagic mucus is discharged from the vulva. This ceases and the cow again is normal. In the heifer the whole process is so trivial that none but an observing attendant would notice it.

Abortion occurring in the second half of pregnancy gives rise to more characteristic symptoms, and the general state of health often is disturbed, even when but temporarily. Abortion frequently happens in the seventh month.

*Premonitory symptoms.*—Cows which are still giving milk at this time—usually the case in localities where they are dry only for six weeks—decrease in milk, and its color and consistency closely resembles colostrum. This is the first sign inducing the attendant to watch her. At this time he can usually observe more, if not on the same day, then on the following one. A limited infiltration of the broad pelvic ligaments has taken place, their posterior border is no longer tense and the ligaments begin to sink down. In some cases the vulva is tumefied, and when the animal is emaciated the flanks are fallen in. Abortion is often preceded by vigorous movements of the foetus. These are reflex movements and are caused by the asphyxiated state of the foetus, due to an accumulation of carbon dioxide in the circulation of the placenta. A rather sudden swelling of the udder at this time is seen in primiparæ, which suggests an approaching abortion. After these symptoms have extended over two, sometimes three days, the prodromes of parturition manifest themselves; in the beginning the animal strains a little now and then, confining itself to the uterine contractions; later the abdominal muscles assist, and regular labor pains set in. The premonitory symptoms may escape the attendant, while the latter phenomena induce him to fear abortion.

*Expulsion of the Fetus.*—By means of the uterine contractions, the cervix uteri is opened and a part of the foetal membranes in the shape of a bladder are driven into the genital canal, in the same manner as in normal parturition. The cervix uteri is dilated less, while at the same time forms no obstacle to the rather small foetus. We may say that in general the same phenomena accompanies abortion as a regular birth, only of lessened intensity. As a rule, the expelling forces need not be supported by traction. The calf is often found lying in the pasture, where the mother, of course, did not receive any aid.

The presentation of the calf may be normal; that is, the head rests upon the anterior extremities. Slow and insufficient dilatation often leads to deviations, as a malposition of the head or forelegs flexed at the knees. As a rule, reposition is easy. The afterbirth usually is retained for some time after birth of the calf. There are cases where the foetal membranes (*secundinæ*) are expelled six to twelve hours after parturition; their expulsion mostly is retarded, which may produce many disturbances erroneously attributed to abortion.

Why is the placenta retained as a rule? First, because the uterine contractions are insufficient to detach the villi of the foetal placenta from those of the maternal placenta; second, because the union of the two placentæ is too firm. We know that even the physiological expulsion of the afterbirth in the cow takes place under less favorable circumstances than with other domestic animals. In abortion, those factors which normally bring about expulsion in three to four hours after parturition, act insufficiently. When abortion is a sequel to diseases of the placenta, where, as the result of a placentitis or apoplexia placentæ, the villi become united by fibrous tissue, retention of the placenta after parturition is a rule, and manual removal of this afterbirth becomes exceedingly difficult.

As a consequence of the retention of the placenta after parturition, metritis, acute puerperal infection, leucorrhœa and pyæmia may arise. (See "Retentio Secundinarum.")

*Frognosis.*—Abortion in the second half of the period of gestation usually does not endanger the life of the animal.

The prognosis may therefore be favorable. The cause of an abortion is of course of great importance in making a prognosis. Although abortion in itself usually takes a happy termination, it may become dangerous when followed by the above named diseases.

*Therapeutics.*—When a cow is once disposed to abort, assistance must confine itself to those measures laid down under normal parturition. The foetal envelopes should not be torn too quickly, anyway not until the cervix uteri is sufficiently dilated. When the whole foetal water is already discharged, frequently the case when the veterinarian is called too late, and the cervix uteri hardly sufficiently dilated to pass the hand, an infusion of warm water, slimy decoction, or oil is indicated. They replace the escaped foetal liquids, and may be doubly useful, by lubricating the passages and by preventing the uteruses from contracting too firmly upon the foetus and thus rendering difficult attempts at reposition. In most cases our advice is only then requested, after parturition has begun. Should it be the case that from former experience with abortion in a herd the attendant imagines to notice premonitory phenomena of abortion, treatment may be instituted. Harms recommends camphor and opium.

[The administration of viburnum prunifolium in these cases, in doses of 30 cc. every hour until 120 cc. have been given, yielded admirable results in some animals about to abort, while in others it had no effect whatever, no doubt depending on the cause of abortion.—W.]

The circulation must be equalized by thoroughly rubbing the belly and legs; the hind-quarters should be raised. Pregnant cows, fatigued by long drives or railroad travel, showing the first indications of abortion, receive the above treatment.

## II.—INFECTIOUS ABORTION.

On page 108 it was shown that stationary abortion need not necessarily be infectious. Strebler reports that during the wet years, 1878 and 1879-80, 20 to 60 per cent. of all pregnant cows aborted in the canton of Freiburg. The stables, which were

clean, had a healthy location. Strebel looked upon as causes of this abortion, first, tainted food, and second, an infection from a decomposing placenta, from which an agent developed, acting especially upon the gravid uterus.

This was also Bouley's opinion. He insists that a septic agent results from the decomposing placenta of a cow which aborts, and which, transferred to other pregnant cows, produces abortion (St. Cyr and Violet).

Already in 1812 Cruzel enumerated infection among the causes of abortion.

Rueff is of the opinion that abortion is caused by a sort of contagion; and therefore in his text-book on obstetrics, as far back as 1878, proposes prophylactic therapeutics; which is still of value to-day and needs but little improvement with regard to more recent investigations.

Experience taught long ago, that abortion, when once occurring in a stable, may spread and produce abortion among many cows. It was also known that the purchase of cows from an infected stable imported the disease. The manner in which abortion spread in a stable where but one case had put in its appearance, by going from one cow to a neighboring cow, etc., put the stamp of infectiousness upon enzootic abortion, although at that time nothing was known about the contagious agent.

Bräuer was the first to prove by experiments that the vaginal mucus of cows which had aborted in a stable where enzootic abortion existed, when transferred to the healthy vaginal mucous membrane of other pregnant cows, caused them to abort; abortion took place in nine to twenty-one days. After abortion he found cocci in the vaginal discharge as well as in the foetal waters.

Franck found micrococci in such vaginal mucus, and looked upon them as the infectious material.

Lehnert obtained the same results as Bräuer. Bräuer later took cotton and saturated it with foetal water and mucus of the vagina of a cow which had aborted twelve hours previously. This cotton was placed for ten minutes into the vagina

of pregnant cows; in nine to fifteen days (period of incubation) eleven cows aborted. These experiments show that the infection may be transmitted by intermediaries. As such, we name: Straw, manure, urine, ropes, stable paraphernalia and the arm of the operator.

Franck reports that a cow which was examined for pregnancy per vaginam aborted after a decomposing placenta had been removed that day (although the arm was thoroughly cleansed.)

Sand, who collected the reports of many Danish veterinarians, also mentions a case where abortion was transmitted by a piece of afterbirth of a cow which had aborted.

The transmission of the infectious material by the bull is corroborated by many observers. Danish veterinarians report striking examples. One breeding establishment introduced a bull which while coming from a healthy herd had been for several days at a farm where abortion existed, but did not come in direct contact with the cows. This bull was placed at his new home among the old cows which he was to serve while the young cows were served by a young bull on the other side of the farm. Of the old cows, twelve to fourteen aborted, the young cows served by the young bull completing their period of gestation. Later investigation showed that the old bull had served some of the cows of the infected stable. Abortions persisted in this case for two years (Nygaard, Sand).

The experiences of Danish veterinarians tell us that cows far advanced in pregnancy, when placed into an infected stable, calve the first year at the regular time, but abort the following year. Many examples have been enumerated, that in certain divisions where abortion was stationary for two or three years, only the first cows aborted. Experience further teaches that the purchase of new cows and the sale of the aborting cows is useless in a stable with stationary abortion. The newly bought cows invariably abort the following year.

Nocard states that in Michel at Azy abortion was permanent for twelve years, and every year one-third of the cows aborted. Every year abortion took place at a later period, so that in the

last year, 1884-1885, no cows aborted. Of the calves born at the regular time fourteen out of thirty-two died one or two days after birth with diarrhoea. According to Nocard, this diarrhoea was produced by the same agent which was the cause of death in those calves dying immediately after a period of pregnancy of seven to eight months.

*Aetiology.*—Already the above shows plainly that enzootic abortion is an infectious disease. The manner in which it occurs and spreads, as also the experiments, prove it conclusively. Braüer already detected cocci in the vaginal discharge of cows which had aborted and in the foetal water. Franck thought that the micrococci present in the inodorous mucus of the vagina represent the infectious material.

Nocard made exhaustive experiments in regard to the aetiology of infectious abortion.

In the first place, it was his intention to answer the following questions: (1) Is infectious abortion a disease common to the pregnant cow? (2) Is it a disease of the genital organs of the mother? (3) Is it a disease of the foetus and its envelopes? In the first two instances the foetus might play a passive role.

He dissected cows which had just aborted, primiparæ which were about to abort, and cows which aborted the preceding year and had not conceived since that time, although repeatedly served. In microscopical examinations of the uterine milk, Nocard found, besides epithelial cells and leucocytes, a great number of short bacilli isolated or in pairs; in the puriform mass, which represents itself as a dirty-whitish fluid on the lower surface of the cotyledon, cocci, either isolated or in chains of 3, 4, 5.

In the uterine milk bacilli were more numerous than cocci. The liquid attached to the uterine mucosa contained both in equal quantity. When inoculating bouillon, the uterine milk furnished pure cultures of short, thick, straight bacilli in twenty-four hours. Bouillon inoculated with the puriform mass gave a mixed culture of micrococci and bacilli. The media remained sterile when inoculated with milk and blood. The second group of the experiments consisted of inoculating

bouillon and gelatine with uterine milk and amniotic fluid of primiparæ about to abort; media were also inoculated with blood. After forty-eight hours the blood inoculations were sterile; the uterine milk furnished the bacilli, and the amniotic fluid a delicate coccus in bunches or short irregular curved chains.

The third examination was made on a cow which had aborted eight months previously and which had been served once a week, without conceiving. The mucous membrane of the uterus was red, moist; the removed mucosa contained a liquid of acid reaction, swarming with bacteria, growing freely in bouillon. Comparative tests on pregnant cows and those which had calved repeatedly showed that the reaction of the uterine mucus in the latter is not acid nor contains micro-organisms. The intestinal contents of fourteen calves either born dead or dying soon after abortion were full of bacteria, confirmed by cultures and staining. In a normal foetus, which has neither breathed nor partaken of any milk, the intestinal tract is sterile.

This explains the cause of the profuse diarrhoea of calves which are born alive at an advanced period of gestation and die soon after parturition; possibly also the simultaneous appearance of dysenteria neonatorum and abortion in the one and the same stable. In three calves which died in the first week after they were born with dysenteria neonatorum, Nocard inoculated calf's bouillon with pieces of the medulla oblongata and got cultures which were identical with those obtained upon the same medium by inoculations with the medulla oblongata of premature births. He asked himself the question whether the peculiar bellowing mentioned by many observers, and supposed to announce the approaching death of the calf, could be explained by these low organisms from the medulla oblongata. The cause of it, same as in rabies, may be found in the paralysis of the vocal cord.

The exact researches of Nocard have materially advanced the aetiology of infectious abortion. He summarizes the results as follows: "Infectious abortion appears to be a disease of the

foetus and its membranes, caused by a low organism, and which do not directly concern the cow."

Galtier, Poncins and Ory observed cases of enzootic abortion, which led them to the deduction that infectious abortion is the result of a constitutional disease of the cow, transmitted to the foetus and caused by bacteria. Their experiments and observations were made on a farm where abortion was enzootic for 20 years.

Here also the young animals born at the right time frequently became ill soon after birth, showing symptoms of broncho-pneumonia and enteritis, occasionally nervous symptoms; they had a fetid diarrhoea and sometimes convulsions. The grown unimpregnated animal, according to their opinion, bears the disease without noticeable symptoms; but as soon as pregnancy occurs the pathogenic agent finds a favorable medium in the tissues of the young. Inoculations with portions of the aborted foetus or foetal envelopes, the disease was transferred to swine, sheep, rabbits, goats and guinea-pigs. The diseases following those inoculations were mainly pneumonia and enteritis.

Prof. B. Bang (Copenhagen), together with his assistant, Veterinarian Stribolt, has made many examinations in regard to infectious abortion, and obtained fine results by his highly interesting experiments. Owing to his kindness, I am able to reproduce verbatim his personal communication :

Enzootic abortion is the result of a slow uterine catarrh caused by a specific, very small bacillus. When a pregnant cow is slaughtered at the time when the first symptoms of an approaching abortion manifest themselves—that is, before dilatation of the cervix uteri—a considerable amount of sero-purulent exudate is found between the wall of the uterus and the foetus.

The exudate, of dirty aspect and almost inodorous, separates into a serous fluid and thick muco-purulent sediment, when put into a glass and left to itself. The exudate contains the pure culture of a small organism which at first sight appears to be a coccus; closer examination shows that it is a small punctated bacillus, which stains especially well. It takes up the ordinary stains; for instance, Loeffler's Blue. The bacteria lie either isolated or are found in enormous numbers in thin large cells (desquamated epithelium), giving them the appearance of micrococci, being aggregated so

closely. The bacilli do not grow in ordinary agar or gelatin agar, develop poorly in bouillon with glycerine, better in bouillon glycerine mixed with serum. They grow best in gelatin-agar-serum (that is, two parts gelatin mixed with one part serum). A culture raised in this medium in a high glass (Liborius) has the peculiarity, that its small colonies only develop in a certain zone, that is, a little below the surface. Therefore, it develops in the zone of aerobic organisms, but not on the surface.

Strange to say, it develops on the surface when *pure oxygen* is allowed to flow over the congealed liquid, after which the glass is sealed with paraffin. This characteristic, of course, is of great assistance in identifying the bacillus.

The introduction of a pure culture into the vagina of a pregnant cow produces abortion in 10 weeks; the same pathological changes are then found as in the spontaneous cases of enzootic abortion. In two experimental cows Prof. Bang introduced cultures twice during the period of incubation; thus it is possible that the time is less than ten weeks; he presumes, however, that this time is correct and that the first inoculation was the effective one.

In the foetal envelopes a considerable gelatinous oedema is constant between chorion and allantois.

In practice, we can readily recognize enzootic abortion by this peculiar advance and the immediately following dirty but inodorous discharge.

The intestinal tract of the foetus at times contains the pure culture of the same bacillus. The organisms are very resistant and remain alive for seven to ten months when kept in a refrigerator.

*Eradication.*—1. Immediate removal of the pregnant cow from the stable, as soon as she offers premonitory symptoms of abortion, to prevent discharge of the infected material into the stable; destruction of the afterbirth, disinfection of the uterus, etc.

2. A special bull must be used for the cows which aborted, as the bull no doubt is often the intermediary of the contagion.

*Symptoms.*—When infectious abortion has repeatedly happened in a stable, or has returned year after year, the premonitory indications of an early expulsion are noticed at an early period. The first changes are in the composition of the milk, which resembles colostrum. When abortion occurs in the seventh month and the animal is dry, approaching abortion is usually not so quickly perceived; an observing attendant recognizes it by the swelling of the udder. At the same time a reddish or brownish-red vaginal discharge is seen; sometimes it is more purulent or dirty white. The vulva is slightly tume-fied, the ligaments sunk in a little. Many observers noticed a

limited dry herpetic exanthema around the root of the tail, anus and vulva (Bräuer, Schneidemühl). This exanthema is not pathognomonic, as it may be frequently seen in a cow with a retained decomposing placenta and also in stables where no infectious abortion prevails or ever existed. After the discharge from the vagina has lasted three or four days, and the other symptoms, as the changed quality of the milk, swelling of the vulva, have been present sometimes for several days before that, follows without severe pains, the expulsion of the calf. Up to this period the general state of health seems to suffer but little, the animal feeds well, ruminates, faeces are a little harder than usual, otherwise mostly normal.

After parturition, which usually takes place without aid, the placenta is retained. In many cases they are expelled within one half to one day after birth; when this does not occur they begin to decompose at the third or fourth day. Now phenomena manifest themselves suggestive of a generally disturbed health. Temperature rises up to  $40^{\circ}$  to  $41^{\circ}$ ; appetite is wanting; rumination is irregular; horns, ears, lower extremities are cold; pulse usually normal. Exploration reveals that the cervix uteri is still sufficiently open to permit the introduction of two to four fingers. With patience and rotary movements of the cone-shaped hand, one passes through the cervix into the uterus. The envelopes are still found attached to the cotyledons, the uterus is but little contracted, the uterine cavity full of a stinking chocolate-colored liquid, appearing upon the arm and hand when retracted as fimbriated streaks. The walls of the vagina and uterus are hot. The exploration is painful to the animal. Matters are not always as bad as this. In most cases the placenta is expelled at the fifth or sixth day, followed for a long time by a badly smelling lochial excretion, which later winds up with a muco-purulent discharge. After expulsion of the afterbirth, the symptoms cease and the animal recovers. But conception does not take place as long as the muco-purulent discharge persists. In some cases sequels appear, as septic metritis, metro-peritonitis and pyæmia, usually in the form of a polyarthritis pyæmica.

*Prognosis*, on the whole, is favorable for the cow. With proper care most cases terminate well.

*Therapeutics*.—While discussing the aetiology, it was remarked that lessened powers of resistance of the body form a predisposing factor. Prophylaxis consists, therefore, primarily, in the prevention of such a state by rational hygiene in the widest sense of the word. Further prophylaxis is to prevent infection and to destroy the infectious material either when existing without or within the body. As regards the latter, the experience of many veterinarians teaches the following rules :

1. A cow which has aborted must be isolated immediately. Whenever possible, all the other pregnant cows should be removed from that stable. In many cases this is impossible for economic reasons, and the aborting cow is removed instead.

2. The foetus, which arrives either dead or dies soon after delivery, is burnt. When the calf is still living, it must be isolated and its faeces must not remain in the stable.

3. The placenta of a cow should be removed by hand and burned unless expelled by uterine contractions. The uterus is then irrigated with a two per cent. creolin solution, to be repeated for several days.

4. The stall occupied by the patient is cleansed, all hay and straw removed, and the whole stall thoroughly disinfected.

5. All manure lying behind the cows must be removed twice daily. The floor is to be rinsed with water every morning after removal of the faeces, and should be sprayed once a week with a three per cent. solution of copper sulphate. Should the infectious agent already have entered the vulva or vagina, it is still possible to reach it.

Besides the therapeutic measures already given, it is advisable to act as follows :

(a) Once daily, the tail, anus, vulva, internal and posterior surface of the thigh must be washed with a two per cent. creolin solution.

(b) Into the vagina of the pregnant cows once weekly a 2 per cent. blood-warm creolin solution is to be injected. In the stable the greatest cleanliness must be observed.

Nocard recommends for the disinfection of the stable floors once a week a 4 per cent. solution of copper sulphate. For the vaginal injections and cleansing of the external genitals and their neighborhood, he suggests the following solution :

Hydrarg. bichlor. corrosiv.....	5.0
Spiritus diluti.....	50.0
Glycerini .....	50.0
Aqua destillatæ .....	20 l.

Nocard advises to practice his prophylactic therapeutics immediately after conception in those stables where abortion reigns.

It is of special importance not to breed cows until the vaginal discharge has entirely subsided. Otherwise there is danger to infect the bull, who may transmit abortion to other cows.

Reindl recommends to fumigate the stable with sulphurous acid, to whitewash the walls and stalls and posts, adding  $\frac{3}{4}$  to 1 kg. of crude carbolic acid to every 20 l. of whitewash. He orders irrigation of the vagina of infected cows, heifers and calves, twice weekly, with a solution of 1 per cent. acidum carbolicum liquefactum, and 1 to 2 per cent. solution of sodium carbonate ; also treats the prepuce of the bull in the same way. Reindl insists to have better results with this treatment than with creolin, carbolic acid or sublimate solutions. He thinks it is in consequence of the alkaline solution.

Bräuer, who first experimentally transmitted abortion to pregnant animals, describes his prophylactic therapeutics as follows: Between the fifth and seventh month of the period of gestation, each cow receives hypodermically 10 to 15 g. of a 2 per cent. carbolic acid solution, to be repeated every 14 days. The tail and external genitals are kept clean and washed with a 5 per cent. carbolic acid solution several times weekly. Many have tried Bräuer's method and report surprising results. Others, on the contrary, have seen bad results from the injec-

tions. Whenever disinfection of the floor of the stable and washing of the external genitals and tail with carbolic acid or creolin solution were added to the hypodermic injection, the results were most favorable.

R. Boer Hzn and J. M. Billroth, in Friesland and Northern Holland, have obtained excellent results from Bräuer's injections, in stables where abortion was permanent.

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## II.

### DISEASES OF THE FŒTUS AND ITS ANNEXES.

#### 1.—Mummification of the Fœtus.

The developing fœtus may die or undergo many changes during uterine or extra-uterine pregnancy. The aetiology will show that the variety of changes depends on different circumstances. Only those changes are discussed here occurring in intra-uterine pregnancy. In regard to the decomposition taking place in the fœtus of normal size, and which may lead to dystokia, I refer to the chapter on "Emphysema of the Fœtus."

*Definition.*—By mummification, that state of the dead fœtus is understood, where the body has experienced a dry necrosis. The fœtus has dried up, the tissue plasma is apparently resorbed, while the macroscopic and microscopic structure of the tissue is still preserved for some time.

The whole forms a solid, hard mass, on which the various parts of the body can still be recognized; therefore the name *stone fœtus*, *lithopædion*, *osteopedion* (Numan, Franck, Forster, Cohnheim).

Such mummified fœtuses are frequently seen in cows. As a rule they are only observed on slaughter, and offer different aspects depending on the time during which they remained in the uterus. This interval, starting with conception, is twelve months to two years, and sometimes even longer. Among others, Figuier reported a case where the mummified fœtus inhabited the uterus five years.

*Ætiology.*—Mummification occurs after death of the foetus only under following conditions: 1. When the air is absolutely excluded. 2. When expulsion is prevented.

The foetus usually dies between the fourth and sixth month; in some cases sooner, rarely later; or at the end of gestation death may be caused by interference with the circulation,—for instance, after torsion of the uterus (*torsio uteri*); then expulsion is also prevented (Franck). But diseases of the foetus and disturbances in the composition of the blood may cause intra-uterine death of the foetus. Besides *torsio*



Fig. 17.—Lithopædion.

uteri, other disturbances making expulsion impossible, may be auxiliaries, obliteration of the *os uteri*, wanting labor pains due to fatty metamorphosis of the uterine muscle, adhesions of the walls of the uterus with adjoining organs, in consequence of which the contractions cannot exert their expelling powers. *Torsio uteri* is the most frequent cause. Many mummified calves have distinct parallel grooves on their surface from the folds of the twisted uterus (Franck). In extra-uterine pregnancy, lithopædions may also form. (See "Extra-Uterine Pregnancy.")

Mummification only occurs when the air is excluded. It is not necessary that the cervix uteri is hermetically sealed ; it may even be partially open, as in a one-fourth revolution of the uterus ; but the foetal membranes must be intact. As long as they are not ruptured, low organisms cannot influence the foetus detrimentally (Franck). Mummification of the foetus takes an aseptic course. Entrance of air may give rise to a chronic metritis, resulting in a mucous-purulent exudate which is tinged red on account of the decomposition of the blood corpuscles of the venous thrombi. The entire process, on the whole, does not affect the cow seriously.

*Symptoms.* — Death of the foetus and the labor pains following it are characterized by phenomena which are often not recognized as such and overlooked. Especially when death of the foetus and the prevented expulsion occur in the fourth or fifth month, the symptoms are of limited duration and of little intensity.

The only thing observed in such a cow is the following : She does not feed well, ruminates slowly or not at all ; the hard faeces are expelled in small quantities and with straining ; micturition is frequent but limited in amount ; the left flank is slightly bloated. Occasionally the animal kicks with its feet against the belly, or stamps with the hind legs, frequently seen in intestinal invagination.

The diagnosis is here usually indigestion, and the cow is treated accordingly. These symptoms decrease in two to four days or disappear entirely, and the diagnosis and treatment are looked upon as correct. At this period the process of mummification begins.

The phenomena just mentioned are caused by the contractions of the uterus ; which are less strong than in normal parturition, as the expelling powers of the uterus are limited. The pains, now and then assisted by the abdominal muscles, were unsuccessful because some disturbance interfered with expulsion. After the uterus eventually becomes fatigued through the repeated contractions, and a few of the foetal placentæ separate from the maternal placenta, the foetal liquor

is very slowly resorbed, so that after a while the foetal membranes are closely moulded to the foetus. The walls of the uterus contract and the mucosa undergoes many changes. The cotyledons undergo fatty degeneration and atrophy, they lose their peduncles, become smaller, appearing finally as long yellowish spots upon the mucosa. The foetal plasma is absorbed, and the skeleton, covered by a parchment-like tissue, remains behind. This process is not characterized by a single symptom. The cow appears perfectly well.

Expulsion of the foetus is manifested by the following phenomena: After the animal has been considered unimpregnated for some time, months, possibly years, and has not been in heat all that time, symptoms indicating oestrus set in (Franck). The cow strains a little; a more or less dark colored discharge mixed with blood flows from the vagina. When the vagina is explored, the mummy is found in the vagina or uterus, the os uteri being sufficiently opened to allow entrance of the hand into the uterine cavity with a few rotary movements. The uterine contractions are, of course, very feeble. The process of involution injured uterine contractility, and consequently expulsion is slow, the foetus remaining in the vagina often for days. The vaginal discharge first induces us to make an examination per vaginam.

*Therapeutics.*—While discussing the symptomatology it was stated that the fruitless efforts of the mother to give birth may escape attention and that no aid is called for on account of the short duration. Close observation of the symptoms might confirm by rectal or vaginal examination an eventual torsio uteri. (See "Torsio Uteri.") During expulsion we must endeavor to hasten it by cautious extraction and lubrication of the genital canal. This is usually not difficult. As after treatment, antiseptic and astringent irrigations, on account of the insufficient contraction of the uterus, are to be employed. Should the uterus contract after expulsion and the foetus and membranes be inodorous, irrigations may be omitted. The discharge from the genital canal following expulsion may be of long duration. In most cases it is of chocolate color.

the first few days, later purulent, muco-purulent and finally mucous.

## 2.—Maceration.

*Definition.*—Maceration, same as mummification, is a necrotic process. While mummification is somewhat of a drying out process, maceration consists of a colliquation (liquefaction). With it the development of low organisms go hand in hand, causing at the same time a purulent metritis.

Although the boundary line cannot be closely drawn between mummification and maceration, there is nevertheless a marked difference in the more pronounced cases of a mummified and macerated foetus. Mummification produces a firm mass, maceration dissolves all soft parts, so that the bones of the skeleton fall apart. In complete maceration even the epiphyses and diaphyses separate; the bones of the head become disconnected at their sutures; the individual bones of the skeleton rest in the uterine cavity amidst a muco-purulent mass.

*Aetiology.*—Maceration usually occurs in the fourth to sixth month of pregnancy, rarely later. Disturbances causing death of the foetus, and at the same time interfering with expulsion, may lead to maceration, provided air enters. Maceration often follows when the foetal envelopes have ruptured and the dead foetus is retained in the uterus.

*Course.*—The dead foetus liquefies and falls to pieces. The mucosa of the uterus develops a chronic inflammation, with a muco-purulent exudate liquefying still further the already softened foetus. This chronic inflammation not only attacks the mucosa, but also the submucosa, muscularis, and serosa, so that the uterine walls become thickened and may develop purulent foci (Franck).

Under favorable conditions the uterus behaves as the wall of an abscess; the changed mucosa and submucosa represent the pyogenic membrane, protecting the body against further infection. But it happens that by continuity a metro peritonitis sets in, leading to adhesions between the uterus and adjoining organs, as the rectum, bladder, intestines and abdominal walls.

Weber tells of a case of maceration where adhesions between the uterus and abomasum took place. The latter was probably perforated by a macerated bone, as a consequence of which food was found in the uterus. In the cow, cases of maceration are, as a rule, followed by a purulent metritis and parametritis,—even adhesions,—but expulsion of the foetus through abnormal passages must be rare.

It is the rule that the bones are evacuated via the cervical canal, or that the patient dies before it can occur with pyæmia.

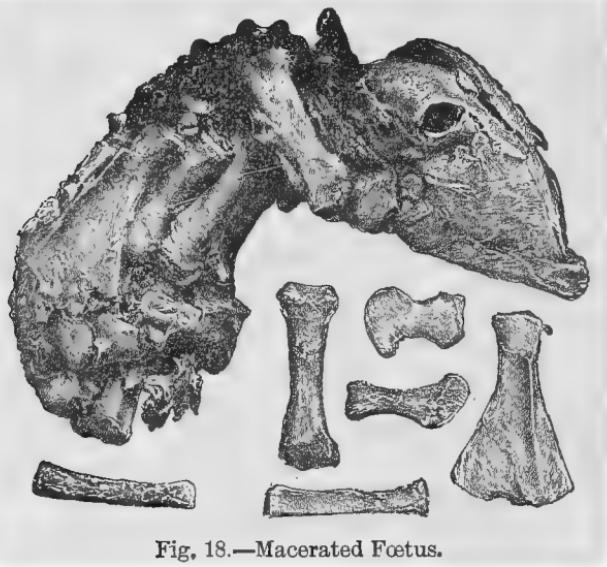


Fig. 18.—Macerated Foetus.

*Symptoms.*—Now and then a small amount of thick pus is discharged from the vagina, so that the owner, imagining the animal not to be pregnant, thinks of leucorrhœa. While the pus is evacuated, bones are also discharged, sometimes lying in the vagina, amidst a purulent mass, days and weeks. The whole process may persist for a long time, months may pass, before the whole of the macerated mass is expelled (Franck).

In most cases, while offering such symptoms, the cow emaciates some, but seems healthy otherwise, eats well, ruminates and gives a fair amount of milk. Straining is only occa-

sionally noticed, so that the veterinarian is called only on account of the vaginal discharge. A local examination reveals the facts. The os uteri is somewhat dilated, two or three fingers may enter when necessary, also the hand by a few rotary movements. The bones of the foetus are found in the uterus surrounded by thick cream-like pus; the mucosa of the uterus is roughened and the walls a little contracted. In some cases the os uteri is closed and a few bones are found in the vagina. It happens occasionally that the cervix uteri opens a little to expel some portions of the foetus. This slight dilatation probably corresponds with a period of oestrus, which may appear regularly with such patients. According to Franck, conception is possible.

In other cases the process of maceration is complicated by the absorption of putrid materials. The purulent inflammation, which migrates from the mucosa to the muscularis and serosa, caused thrombosis of the veins of the uterus. The uterus is also predisposed to a generalization of this process on account of the reticulated lymph system between its longitudinal and circular layers.

The thrombi decompose after invasion of the pathogenic bacteria, enter the circulation and may produce a metastatic pneumonia or a polyarthritis pyæmica, which has been observed several times.

*Prognosis.*—The course is usually favorable when the process of maceration has advanced to such a degree that perfect dissolution has taken place, the bones enclosed in a mass of pus, some pieces already discharged from the uterus, without disturbing the general health of the cow; a perfect recovery is then possible. At the same time, phenomena indicating the resorption of putrid material into the circulation make the prognosis unfavorable. Such symptoms are: Arthritis of the tarsus, carpus or femoro-tibial articulation and metastatic pneumonia, usually of a chronic course, characterized by emaciation, cough, etc.

*Therapeutics.*—When the attendant or owner has observed a purulent vaginal discharge for some time, possibly the expul-

sion of bones, and the attending veterinarian detects on examination the status quo, his first duty consists in the removal of all foreign bodies from the vagina or uterus. In most cases the purulent flow persists for a time, gradually decreases, becomes mucous and finally ceases. Irrigations of the uterus with a 2 per cent. alum solution are indicated. A subcutaneous injection of ergot (*extracti secalis cornuti*, 5.0; *glycerini et aq. ana.*, 5.0) should be given to stimulate uterine contractions.

### 3.—Anomalies in the Umbilical Cord.

Anomalies of the funis have been investigated but little in the cow. It probably occurs more frequently than is generally accepted. In many a case death of the foetus may be caused by it, although not detected.

The accumulation of Whartonian gelatine on the funis, the so-called false knots which are frequently seen in man, while of little importance, I have never been able to find in a great number of foetuses examined with that view; the true knots of the umbilical cord, produced by a rotation of the foetus around the transverse axis, have also not been observed in our domestic animals.

They are credited with causing death and early expulsion of the foetus. Spontaneous amputation of an extremity from constriction of a part by the umbilical cord is very rare (G. Sand and Nocard).

How far varicose umbilical veins are concerned in the production of serious hemorrhages is not yet decided in the cow. Further observations along this line are desirable.

Of greater importance in obstetrics are :

### 4.—Diseases of the Placenta.

The different anatomical arrangement of the placenta of the cow is the cause that the disturbances of this organ are quite different from those of animals with a diffused placenta. Here diseased states concern mostly single cotyledons, so that any disturbances which would arise from morbid changes in

certain cotyledons are often equalized by the remaining healthy cotyledons. The termination of diseases of the placenta may become of great importance from an obstetrical point of view. Diseases of the placenta may be divided into three groups: *hemorrhage, inflammation and tumors*.

The simplest form of hemorrhage is capillary apoplexy. It is caused by a rupture of capillaries, and in consequence of the extravasated blood the adhesions between single villi of the chorion and corresponding villi of the maternal placenta are destroyed. In cases of more serious hemorrhage or extravasations, the blood mixes with the uterine milk, forming a chocolate-colored fluid (Franck).

*Sequelæ*.—Limited hemorrhages and separations of a few cotyledons do not influence the foetus materially, as sufficient collateral circulation exists. The extravasated blood is absorbed and only a little pigment remains, which may be seen later upon the chorion or placenta materna of pin-head or pea size. Such small hemorrhages do not give rise to clinical phenomena, as the *cervix uteri* is closed and the process an aseptic one. Nevertheless, another termination is possible—the formation of connective tissue. Out of the small amount of connective tissue in the villi cell tissue may be formed; in this case the extravasation is resorbed and adhesions between the placenta follows. Greater hemorrhages, the result of rupture of blood vessels, is accompanied by an accumulation of blood between the chorion and uterine mucosa. This may lead to extensive separations of the foetal placenta. Here the life of the foetus is endangered by asphyxia, when the blood supply becomes insufficient. In such a case, often a limited dilatation of the *cervix uteri* is seen, permitting the discharge of some blood from the vagina; this also occurs occasionally in very small hemorrhages. This phenomenon is known as *hemorrhage from the uterus, or metrorrhagia*.

*Symptoms*.—The attendant's attention is first attracted by the flow of blood from the vulva. Small hemorrhages are characterized by a little coagulated blood now and then, more extensive ones by the discharge of liquid blood. The general

health need not necessarily suffer. It sometimes happens during pregnancy that quite a quantity of blood is evacuated. After losing about one liter, the hemorrhage ceases and the patient recovers; but the course may be a different one. As a result of the hemorrhagia and loss of blood, a collateral anæmia of other organs sets in, the cow is attacked in a few hours by anæmic convulsions, and dies. Such a virulent termination follows rupture of a larger blood vessel. The prognosis of such a hemorrhagia uteri must be a careful one. Hemorrhages quite small at first often develop serious sequels. This depends on the limited dilatation of the cervix uteri, thus interfering with the free flow of blood, at the same time a good deal of blood may be contained within the uterus. We must also remember that in the standing posture the extravasated blood does not discharge through the vagina, but accumulates in the uterus, and only in the recumbent position is it discharged in a stream. All this must be considered and a guarded prognosis made.

*Therapeutics.*—When the local examination and the correct diagnosis are made, the treatment depends on the amount of extravasated blood. Small hemorrhages only call for absolute rest. Frequent explorations are dangerous, while irrigations are apt to destroy the life of the foetus. Therefore an expectant treatment is indicated, of course only, I repeat, in small hemorrhages which do not endanger the life of the mother. When the hemorrhage endangers the mother's life, prompt interference is required. In these cases the os uteri is usually sufficiently dilated to pass the hand into the cavity of the uterus.

The treatment next consists in producing, as quickly as possible, uterine contractions, and, in consequence, cessation of the hemorrhage. These contractions, of course, are only possible when the foetus has been previously removed. Artificial abortion, therefore, is to be instituted, together with application of such remedies as are enumerated under post partum hemorrhage ("Metrorrhagia Post Partum"), to which the reader is referred.

*Inflammation of the Placenta* (placentitis) does not offer any symptoms during pregnancy which enable us to make a positive diagnosis. Although exact investigations have not been made along this line in our domestic animals, it no doubt happens quite frequently.

Tapken (at Varel) describes a case where the chorion presented grayish proliferations of hazel-nut size, which were connected here and there with accessory placentæ. Placentitis cannot be diagnosed intra vitam, although its termination is of great importance to veterinary obstetrics.

Adhesion between the foetal and maternal placenta confines itself to a few places. It consists of a union of the connective tissue of the villi of the chorion and that of the villi of the maternal placenta. These adhesions are one of the causes of retention of the placenta. Occasionally calcium salts are precipitated (Cagny). Tumors on the placenta are rare; an occasional myxoma has been observed.

### 5.—Dropsy of the Fetal Membranes. *Hydrallantois*,                                   *Hydramnios*.

In veterinary literature many cases of dropsy of the foetal envelopes are described.

Brannens (St. Cyr and Violet) already in 1829 described dropsy of the foetal membranes in his "Observations sur une hydromètre intra-membraneuse." According to his description, he was dealing with a hydrallantois, his prognosis in these cases being on the whole a favorable one. In speaking of the dropsy of foetal membranes, one usually refers to an extraordinary accumulation of allantoic liquor. In man, dropsy of the foetal envelopes confines itself to hydramnios, as the allantois is absent in advanced pregnancy. Hydramnios occurs in the cow, as I found it on post mortem of a cow in which dropsy of the foetal membranes had been diagnosed during life. The sac of the amnion contained 25 l. of a thin, slimy liquid. Most of the reported cases, however, refer to hydrallantois.

*Definition.*—By hydrallantois is understood an extraordinary accumulation of fluid in the sac of the allantois, dilating the latter greatly and increasing the dimensions of the uterus to such an extent that disturbances may ensue. As much as 170 l. have been found (Hess).

*Aetiology*—Hydrallantois as a disease *per se*, depends on disturbances of the foetus or its annexes without necessarily involving any organ of the mother from an aetiological point of view. In many cases the only cause is found in the foetal envelopes.

In hydrallantois, most authors—which is also my experience—have found normally developed calves, and no dropsical ones (Hess, Kammermann, Kronburger, Tapken).

Franck insists that hydrallantois and dropsy of the cavities of the body of the mother are often associated. Kammermann also looks upon hydramia of the female as a cause of hydrallantois. This may have been observed in some instances, but in the majority of cases the cause does not exist with the mother.

The increase of allantoic fluid may take place in two ways: first, by increase of foetal urine; and, secondly, by transudation. The former cannot be very great, on account of the limited activity of the foetal kidneys. At the same time, but little is known about foetal kidney diseases in animals.

The second course is of greater importance—the transudation, following circulatory disturbances of the placental blood vessels. According to Kitt, hydropsical changes of the chorion depend mainly on a stasis hyperæmia started by torsion of one or more portions of the foetal membrane, while other parts still adhering to the placenta materna and in a normal state supply the embryo with nourishment.

Kitt states that in ruminants crowding of the foetal membranes and torsions are very liable to occur, as the chorion forms fold physiologically, since the embryo and its membranes are too long for the uterine cavity during a certain period of gestation (Bonnet).

Hess observed, in a post mortem of a cow suffering with

hydrallantois, an abnormal torsion of the umbilical cord and a marked oedema of the allantois, chorion and placenta.

*Symptoms.*—The veterinarian, when called to attend to such diseases, finds a hydropsy of great dimensions, accompanied with well marked phenomena. The first symptom observed by the attendant is the distension of the abdomen, already enormous in the sixth or seventh month. It is readily seen that he should mistake the abnormal distension for multiple pregnancy. Since the cow, in spite of good care, becomes more and more emaciated, he finally concludes that something else is the matter.

Examination of such an animal reveals the following symptoms: The belly is very much distended, especially at its most dependent portion. At first this distention is localized in the right lower abdominal region, but later also in the left one. The flanks are sunk in more or less; the transverse processes of the lumbar vertebrae are plainly visible, the ligaments are tense, the udder flabby. Usually the cow is very much emaciated, and appetite has decreased; later there are dyspnoea, costal respiration exaggerated; micturition and defecation often normal. Whenever the belly becomes distended to a marked degree, the animal prefers to stand up; she lies down but a short time, resting upon the hocks and knees, not on the side. The increased pressure in the abdominal cavity pushes the diaphragm forward, producing dyspnoea. Toward the end of the disease the cow utters an expiratory moan.

Cases have been met with where the distension of the belly was so enormous as to produce rupture of the abdominal wall and uterine hernia (v. Lindenberg). In rare instances, early expulsion of the foetal membranes takes place.

*Diagnosis.*—The early recognition of this disease is of the greatest importance, as it leaves some chances for the recovery of the mother. Before a diagnosis can be made, an external examination of the abdomen, and a rectal, respectively vaginal, exploration are necessary.

Palpation of the right abdominal region for the foetus, and

succussion as practiced in examination for pregnancy, is almost always negative. Occasionally we succeed in hearing a flushing sound on succussion, but this symptom is also observed in ascites. Remembering the lessened resistance of the greatly distended abdominal walls, succussion must be executed cautiously. Rectal examination detects a constricted state of the rectum; that is, the hand is advanced with more difficulty than in the normal condition. The enormously distended uterus may be palpated on the right when the arm is introduced above the elbow. It appears to occupy the whole abdominal cavity. The uterus feels like a tense, elastic organ of enormous dimensions. Occasionally the calf is detected. On exploring the vagina, the os uteri is either closed or permits the entrance of one or two fingers. The vaginal wall right above the os uteri projects into the lumen of the vagina, feeling like a distended bladder lying just above the vaginal portion of the uterus (Hess). The increased pressure in the abdominal cavity pushes the superior vaginal wall backward.

The *differential diagnosis* is especially directed to distinguish between ascites and hydrallantois. The course, the external examination and the rectal exploration are decisive.

*Course and Prognosis.*—Hydrallantois always endangers the life of the cow. The further pregnancy has advanced, and the better the general health of the animal, the greater the hope for a favorable termination. There are cases where distention of the belly as the result of hydrallantois only manifests itself toward the end of the seventh month or beginning of the eighth month. Such animals sometimes stand it up to the normal time, evacuating a great deal of foetal water at parturition. The process of involution of the uterus, while abnormal, usually does not lead to fatal terminations.

In other cases, especially where the accumulation of fluid increases rapidly, the symptoms are already noticeable in the seventh month. When the cow gets daily bigger, as it is termed, a fatal termination may be expected, unless proper assistance is rendered. In these animals the dimensions of the

belly increase rapidly, respiration becomes difficult, appetite and rumination are lessened, the animal becomes a mere skeleton and dies unless slaughtered before. Hernia of enormous size and ruptures of the uterus are also met with. Spontaneous recovery in cows with hydrallantois, so to speak, occasionally takes place by abortion. Although the latter occurs but rarely, it is a most favorable termination.

*Therapeutics.*—Therapeutic measures depend on the cause. The cause must be removed. We are able to do this by producing artificial abortion. Thus the foetal waters are evacuated and the detrimental influences exerted by the greatly distended uterus upon the other abdominal viscera cease. In those cases where the fingers can enter the cervix uteri, treatment is exceedingly simple; the membranes are perforated and waters allowed to discharge. After some time labor pains begin and the foetus can be expelled or extracted.

In most cases the finger cannot even enter the os uteri. Although it is possible to dilate the cervix uteri (see "Partus *Præmaturus Artificialis*"), simpler means are at our disposal to temporarily relieve the cow, by relieving the intra-abdominal tension; this may be followed by parturition. This is done by puncturing from the right abdominal wall. Cartwright originated this method. St. Cyr and Violet, and also Göring, do not recommend this method, the former especially advising against the use of the trocar and canula.

I myself have operated in this manner several times in hydrallantois, without observing any injurious effects (also Leimer and Ymker). Parturition was occasionally retarded, which induced me to open the cervix uteri and produce abortion.

It does not matter how abortion is produced, as long as it is done early and carefully. After discharge of the foetal waters, labor pains are weak, as the uterus was so greatly distended. The calf therefore must be extracted,—by no means always an easy task, since the foetus is hard to reach. Whenever necessary, therefore, the cow is put on her back.

Too rapid an evacuation of the foetal waters must be avoided, as it may produce a collateral cerebral anæmia; the

same is seen in puncturing the rumen when the gas is allowed to escape too quickly. The puncture is made in the right lower abdominal region under aseptic precautions with Charlier's trocar.

After removal of the foetal waters, the skin of the abdomen is pushed inward as the canula is withdrawn. One or two days later feeble uterine contractions set in, the os uteri opens sufficiently to be dilated mechanically and permit extracting the foetus.

The after treatment of such cows is of vital importance. It was mentioned previously that the expelling forces are of little intensity. Retention of the afterbirth is consequently a rule. Measures must be applied to contract the uterus as much as possible (Franck, Kammermann). The manual removal of the foetal envelopes is mostly impossible, but a few cotyledons are accessible to the hand. It is best to irrigate the uterus once daily with a 2 per cent. alum solution. A subcutaneous injection of 6 to 10 g. of ergot (*extractum secalis cornuti*) is often accompanied by excellent results. It is also advisable to rub the belly three times daily with spirits of camphor.

Internally, tonics and stimulants, such as the best of food, iron, coffee, may be given.

The process of involution of the uterus is here a prolonged one, and the after treatment must endeavor to prevent sequellæ; especially from retention of the foetal membranes.

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### III.

#### EXTRA-UTERINE PREGNANCY.

##### GRAVIDITAS EXTRA-UTERINA.

As a rule, the foetus develops within the uterus, exceptionally outside the uterus; therefore the designation *graviditas extra-uterina*. The impregnated ovum may further develop on

the peritoneum, in the ovary and the oviduct. We therefore recognize *gravitas abdominalis*, *gravitas ovarialis* and *gravitas tubaria*, or salpingocyesis.

*Graviditas abdominalis* (abdominal foetation) is the most common form of extra-uterine pregnancies. Here the impregnated ovum is not carried away by the tube, but falls into the abdominal cavity. In a previous chapter it was mentioned that impregnation of the ovum may occasionally take place in the ovaries, provided the Graafian vesicle is ruptured. When this ovum is not caught by the fimbriated portion of the Fallopian duct, the impregnated egg may develop in the abdominal cavity, giving rise to a primary ventral foetation. The annexes are formed by the egg, and only the placenta materna is to be replaced. It is a fact that a regular placenta replacing the placenta materna develops on that part of the peritoneum where the impregnated ovum is located. At that spot vessels are formed, cell proliferation and thickening of the serosa take place, resulting in the formation of the placenta, mentioned above (Franck). The foetus may mature here, as it is nourished from the walls of that neo-formation. In extra-uterine primary pregnancy the uterus does not participate any whatever in the development of the foetus (Bovy).

*Course.*—When the period of gestation is at an end, the same changes, only less intense, seen during normal parturition take place. The pains are weak, and the cervix uteri is dilated but little. Since the uterus does not deviate any from a normal state, the contractions of the muscularis are necessarily weak. The abdominal muscles may assist, and thus pains simulating labor pains occur. After this condition has persisted for several days, pains cease, the foetus dies, and when the air is excluded those changes known as mummification set in. The foetus becomes a *lithopædion*, possibly remaining for a long time without producing any deviations from normal health. Very rarely, maceration of the foetus may follow (Härtle). St. Cyr and Violet report a case by Coquet where maceration of the foetus was observed. After adhesive inflammation opposite the vulva set in, abscess formation and perforation in the

intestinal lumen followed. The bones were expelled with the faeces. The uterus was empty, its fundus thickened, but without a cicatrix.

*Symptoms and Diagnosis.*—From conception until the end of pregnancy nothing abnormal is noticeable in such cows. Their general behavior does not differ from a normal pregnant state. *Graviditas abdominalis* is not established with certainty during life. An external examination does not reveal anything, while rectal or vaginal exploration allows us to surmise this abnormality.

*Therapeutics.*—In cases where the air is excluded, we may wait for mummification, although it is to the interest of our client to slaughter the cow. The proper treatment is *laparotomy*, which should not be postponed too long; when operated under proper aseptic precautions, this procedure is less formidable than is usually imagined.

Another form of *graviditas abdominalis extra uterina* is known as *secondary foetal pregnancy*, in which the first development of the foetus occurred in the uterus. This may follow rupture of the uterus. As a consequence, the foetus glides into the abdominal cavity and dies, although the possibility exists that union with many maternal placentæ might be continued and the foetus live (Hess). Such a rupture is mostly followed by a serious haemorrhage, often causing death of the mother.

Developments of the foetus in the ovary is termed *graviditas ovarialis*. The causes of this state are still rather obscure. Müller describes such a case in a cow; the foetus having reached the age of two and one-half months. The specimen is in the museum at Vicuna. Ovarian pregnancy is so rare in the cow, that, considered from an obstetrical point of view, it only need be discussed briefly. The same refers to *graviditas tubaria*; which so far has not been observed in the cow.

Franck is of the opinion that complete development of the foetus is not possible in the two last named forms, as the walls are not sufficiently elastic, resulting in a rupture. Following such a rupture, a secondary abdominal pregnancy, if not death from internal haemorrhage, would follow.

Veterinary literature mentions a few cases of vaginal pregnancy (*graviditas vaginalis*), (Deigendesch, Bosetto-Macario, Streb). In these cases it is questionable whether the foetuses, already dead when found, developed at all in the vagina. It is more reasonable to presume that they came from the uterus and remained in the vagina (Franck), and as a result of their presence caused disturbances of the vaginal mucosa, resulting in a roughened and shaggy state. Streb describes a case where vaginal and uterine pregnancy existed at the same time. The foetus lying in the vagina was expelled at the fifth month, the other at the normal time.

## D.—ABNORMAL PARTURITION, DYSTOKIA.

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### I.

#### ABNORMALITIES IN THE MOTHER.

##### 1.—Displacement of the Pregnant Uterus.

The normal position of the gravid uterus is in the right lower abdominal region. The long axis of the impregnated horn and the long axis of the vagina do not form a straight line, but an angle. The direction of the long axis of the impregnated horn deviates toward the right on account of the diagonal position of the uterus in the right lower abdominal region. The greater the descent of the abdomen, the greater this angle. The cause of this physiological deviation is found in the direction of the rumen—from the left flank to the right lower region of the ribs.

Two deviations of great importance in obstetrics are observed in the cow: *anteversion* and *torsion*. By anteversion (which term indicates in the human female a forward flexion of the body of the uterus), we understand an abnormal position, where the long axis of the impregnated horn forms an angle of 45 to 90 degrees with the long axis of the pelvis; that is, the long axis of the calf forms an open angle with the long axis of the mother.

Anteversion is almost exclusively seen in pendulous bellies, but also in hernia uteri in the linea alba or laterally to it. Anteversion therefore is accompanied by a very slight rotation around the transverse axis.

In *torsio uteri*, twisting around the long axis takes place. When we imagine the gravid uterus as hanging on the broad ligaments, supported by the abdominal walls, then in *torsio*

uteri the superior wall has become the lateral wall, provided a quarter revolution took place.

(A) ANTEVERSIO, OR INFERIOR OBLIQUITY, OF THE UTERUS.

Descent of the uterus can only take place under certain conditions, as in the horizontal posture of the domestic animals the right lower abdominal wall supports the uterus and its contents.

In man the uterus may be flexed forward or backward (anteversion and retroversion). Retroversio uteri does not take place in the cow, at least has not yet been observed.

*Etiology.*—Anteversio uteri occasionally occurs in the cow (here the calf has sunk toward the udder, *deviation en bas*, Rainard). Especially in pendulous bellies, or in old cows which calved frequently, a state may occur where the long axis of the pregnant horn is almost vertical. Such a deviation may be caused by a hernia uteri or tearing of the rectus abdominis muscle from the pelvis.

Van Lent (Holland) reports a case where in an eight-year-old cow the right rectus abdominis tore loose from the pelvis. This rupture happened six weeks before the end of gestation. The belly descended until at last it touched the ground. The owner was desirous of waiting for parturition in order to save the calf. Birth terminated favorably, although the calf was felt to be in an upright position. Some days later the cow was killed.

*Symptoms.*—This abnormality is of but little moment to the mother during the period of gestation. The deviation, taking place very gradually, does not interfere with the functions of any organ; but at birth the expelling powers cannot be fully displayed on account of the descent of the uterus, and expulsion becomes difficult. The dilatation of the cervix uteri is insufficient; the preparatory stage, or the time when this takes place, is very much prolonged. When exploring per vaginam, the os uteri is found to be sufficiently opened that the calf may be reached after practicing a few rotary movements

with the hand. This in due time is generally followed by a sufficient dilatation.

The position of the calf, parallel with the long axis of the uterine horn, forms an angle of about 90 degrees with the extension of the pelvic axis. In consequence of this, the head pushes against the sacrum, while the two forelegs either enter the genital canal or are pushed back.

The preliminary pains may advance the water-bag into the vagina; under those circumstances dilatation is sufficient, but the pains may produce an early rupturing of the foetal membranes, followed by a discharge of the greatest part of the foetal water and insufficient dilatation of the cervix uteri.

The expulsive pains, representing a power acting in the direction and against the sacrum, do not expel the calf, but gradually weaken until the act of parturition comes to a standstill.

*Therapeutics.*—When the os uteri is insufficiently dilated and the foetal membranes are intact, the hand by rotary movements attempts to dilate the cervix uteri. These manipulations excite labor pains, by which the water-bag is forced into the cervical canal. The latter may be assisted by stroking it with the hand and at the same time dilating the cervix with the dorsal portion of the hand so that the water-bag enters the vagina. For this operation the *recumbent position* of the cow is best; this changes the relationship between the long axis of the pregnant cornu and pelvic axis; at the same time the abdominal muscle may render assistance. When the foetal water has been expelled and the dilatation is insufficient, great quantities of warm water ought to be introduced by the use of a funnel and rubber tube. The dilatation of the cervix may be effected in the same manner, as repeatedly stated. After such preparation of the genital passages, extraction of the calf is in order. It was previously stated that the expelling powers act under such unfavorable circumstances, that parturition is impossible. Therapeutics therefore has to fulfil two points:

1. The long axis of the uterus must be brought on a line with the pelvic axis.

2. The expelling forces are to be assisted by traction.

To execute the first, the abdomen of the cow, being in a standing posture, is elevated as far as necessary by means of a covered board, handled by two assistants. This method, which may be modified variously, aids us greatly in the attempts to hold the calf. For this purpose a loop is placed around the inferior maxilla and also around the forelegs at the fetlocks.

Extraction requires great caution, as undue pulling may produce rupture of the uterus. The force exerted by two persons having a good foothold suffices for a total extraction. Should the calf be in a normal presentation, but its relative or absolute size interfere with extraction, embryotomy becomes necessary.

Many obstetricians follow Schaack and place the cow on her back, a method of value when the calf is beyond reach. This renders the long axis of the pregnant horn almost horizontal and in line with the pelvic axis. After the foetus has been placed into a normal position and head and forelegs fixed, extraction may be practiced.

When extraction takes place in the dorsal position, the rather short duration of parturition and the direction in which traction is exerted must be considered. The cow does not stand the dorsal posture very long, and active traction in this position may injure the sacro-iliac articulation. To prevent such accidents the head and forelegs of the calf only are fixed while the cow is on her back, allowing her to rest on the belly afterwards. Both factors—that is, the expelling pains and the abdominal muscles—act more forcibly with the cow on her abdomen, thus assisting extraction. After-treatment in such animals can usually be omitted; the process of involution usually takes its course without disturbances. It is advisable not to breed such an animal, as this state becomes worse at each pregnancy.

With excessive anteversion, it is possible that during labor pains a portion of the uterus in front of the pubis may enter into the lumen of the pregnant horn. This inflexion only

occurs when the horn is almost vertical or its anterior portion inclined backward.

After the water-bag has ruptured and uterine contractions set in, an inflexion of the inferior uterine wall may possibly take place. Exploration of the parts reveals, on entering with the hand into the uterus, a fold, which may be so large as to almost reach the opposite wall of the uterus. In such a case the hand, so to speak, is contained in a sac, through the walls of which the calf is felt. Should the fold be less extensive, the hand may pass over it into the cavity occupied by the calf. It is plain that *inflexio uteri* is only possible after the cervix has been dilated and the foetal water partly escaped. It almost exclusively follows a high degree of anteversion.

Rainard already in 1850 mentions, in his "*Traité complet de la Parturition*," that Schaack observed three such cases. Our literature is limited in this respect, although a few cases have been reported.

Some years ago I reported a case of *inflexio uteri* in a cow at a meeting of veterinarians. The belly of this animal was so greatly distended that the owner supposed it due to twins. After laboring half a day unsuccessfully, my assistance was requested. On examination I found the os uteri open and a small calf in the posterior presentation with its hind legs against the abdomen in front of the pelvic inlet. After correcting this position, the calf was extracted by the hind legs. I now examined the cow again, for an eventual second calf, and detected in the left side a sac through which another foetus could be palpated, but I was unable to reach the calf. The cow was allowed to rise and led out of the stable to more roomy quarters, to diagnose the described conditions and to deliver the second calf. Exploration now revealed that the sac had disappeared—probably the result of moving the cow—and that the water-bag was already in the genital passage. In this case the inflexion became corrected spontaneously, and the second calf, being in the anterior presentation, was easily born.

Such cases occur perhaps more frequently than we imagine. Small folds do not interfere with extraction, although it is

possible that the fold, being as thick again as the uterine wall, may become fastened at the pubis during rapid and strong extraction, producing rupture.

The presence of such an inflexion during extraction, predisposes to rupture of the uterus.

*Treatment* consists in elevating the posterior extremities. If possible, the cow should be moved about, as exercise usually removes the inflexion.

Schaack advises to put the cow on her back. Rainard suggests to raise the abdomen of the cow with a sheet immediately in front of the pubis.

In some cases where the uterus contracts, clasping the calf, inflexion cannot be corrected by placing the cow on her back and elevating the hind legs. Under such circumstances large quantities of warm water are to be introduced into the uterus, followed by the above mentioned manipulations.

Veterinarian Reimers (at Ruinerwold, in Holland) has treated, as he told me, twenty cases of inflexion. It is his opinion that it can only take place after evacuation of the foetal water and cessation of labor pains. On exploration, he could only reach the calf when introducing the arm as far as the shoulder. An inflexion was found in front and below the pubis, and behind it the calf. His treatment consists in elevating the cow behind and raising her belly with a covered board at the same time. Extraction, as a rule, is easy.

#### (B) TORSIO UTERI.

By torsio uteri is understood a rotation of the uterus around its long axis, either to the right or to the left. On account of this displacement of the pregnant uterus, expulsion of the foetus is impossible, and as a result of circulatory disturbances both foetus and mother may die.

*History.*—Most writers, among others Rainard, Saint Cyr, Harms, state that Boulolle was the first to mention this deviation in 1766; while not describing it under that name in his "Parfait Boulolle," there can be no doubt that he dealt with a torsio uteri. In the works on obstetrics edited after that time,

torsio uteri is not mentioned until 1829; it seems to have been unknown to writers of that period.

Neither J. G. Eberhard (1793), who studied obstetrics under Kersting at Cassel, nor Skellet (1811) and Binz (1830), mention torsio uteri, not even under another name. In Rainard's work, "Traité de la Parturition," the author mentions on page 415 that Maurin and Vicillard described torsio uteri in 1823.

Prof. A. Numan reported (1831) a post mortem made on a sheep in 1829. He thought "that the right pregnant horn of the uterus seemed to be connected with the cervix by a twisted cord. The broad ligaments, the Fallopian tubes, ovaries and the whole left horn of the uterus were wound around this part of the uterus, until the whole appeared like a large cord."

Irminger and Schenker (1829), Schmid and Vix (1839), Rychner in his "Bujatrik" (1840, page 175), Bleiggenstorfer and Schneider (1843), Dénoe (1845), have all described torsio uteri. Dénoe and Dieterichs, the latter in the "Rec. de Med. Vet," 1845, report that German and Swiss veterinarians already in 1845 described this torsio uteri, and use the expression "torsion du col de la matrice."

*Topographical Anatomy.*—The gravid uterus, on account of the diagonal position of the rumen, lies in the right lower abdominal region. In front it is related to the third and fourth stomachs, on the left to the rumen, on the right to the abdominal wall. The anterior portion is covered by the great omentum. The uterus is fixed by the mesometrium, which consists of two folds of the peritoneum, descending from the sub-lumbar region to the uterus and form its serous layer. In the cow, these suspensory ligaments, also known as broad ligaments (*ligamenta uteri lata*), are possessed of anatomical peculiarities of importance to the aetiology of torsio uteri.

The broad ligaments are attached to the spinal column of the sub-lumbar region and on the parietes of the flanks. On reaching the uterus, they envelop it, forming its outer layer or serosa. In the cow, the broad ligaments are attached to the lateral walls of the uterus, and even a little below them; so, if

we imagine the uterus suspended by those bands, its greater part lies above them.

Chauveau already in 1848 pointed out this anatomical arrangement. The more pregnancy advances, the thicker become the broad uterine ligaments. Already in the second half of gestation the ligaments are quite muscular, as stripes of muscle tissue form in the serosa, as also hypoplasia of the elastic and connective tissue. The uterine artery and vein anastomosing freely, course in the suspensory ligaments. By the contractions of these muscular elements the uterus may be elevated. In discussing "Labor Pains," it was stated that the beginning of each pain represents a contraction of the ligamentum uteri.

The mesometrium is not attached all along the lateral border of the pregnant horn. The anterior part of the horn, which is turned toward the diaphragm, is not fixed by the ligaments, but is free. The body of the uterus is attached to the vagina by the cervix, the vaginal portion of which lies free in the vagina. Although the different organs have a definite position in the abdominal cavity, the possibility of a displacement is not excluded. One deviation was anteversion; here we have to do with a rotation on its long axis. The latter, quite frequent in practice, and almost confined to the cow, is quite possible on account of the anatomical arrangements just described.

*Frequency.*—Torsio uteri is usually met with in cows which have calved repeatedly, but occasionally a case has been observed in primiparæ (Felder, Buhler). It is a frequent cause of dystokia. In the ambulatory clinic at Zürich, of 130 cases of dystokia, 29 were torsio uteri, and of these, 16 to the right (Ehrhardt).

Most cases occur during or after the preliminary stage. Saake claims that according to his experience torsio uteri is never observed before dilatation of the cervix uteri. Mayr, John, Beel, Felder, Veenstra, Baer, have observed an occasional torsion during pregnancy in the fifth, sixth, seventh and eighth months. In the discussion of mummification, it was

stated that torsion is frequently a cause of it, and that the mummy may show the marks of the twisted uterine walls; the foetus presenting a spiral depression on its thorax. Torsion at the sixth or seventh month often escapes observation and may lead to the formation of a lithopædion or maceration. This must always be remembered when examining a pregnant cow.

*Ætiology.*—The malposition of the uterus designated as *torsio uteri* only occurs in the pregnant state. In man, rotation of the uterus on its long axis has occasionally been noticed during operations. The revolution did not exceed 180 degrees and was caused by a tumor (Möschung). Rueff reports an analogous case in a cow where the uterus rotated in consequence of an enormous enlargement of the kidney, which weighed 15 kg.

Torsio uteri, it is safe to state, occurs exclusively in the pregnant cow in the second half of the period of gestation, in the majority of cases immediately before birth, as we shall see later.

The causes may be divided into two main groups: predisposing and direct causes. The former rest on the anatomical arrangement previously described, and on the fact that the uterus has sufficient room to rotate, as seen in cows which rise on the hind legs first while still on their knees in front. In consequence of this oblique posture, the rumen and intestines slip forward, giving the uterus more room, and its anterior portion, not fixed by the mesometrium, may rotate. It has also been observed that in places where the cows stand too closely together and therefore are obliged to lie down and get up as just described, *torsio uteri* became more frequent than before that time, where each cow had a roomy stall (Franck-Göring). The relaxation of the suspensory apparatus of the uterus and abdomen has also been brought under this category of causes.

The direct cause of the rotation must be an active one, and, in fact, may exist.

In discussing the anatomy, the diagonal position of the rumen was described. The volume of this organ is very changeable. It is true that it occupies a definite position in the

abdominal cavity, but its dimensions vary. Many investigators are of the opinion that excessive distention of the rumen, as observed in tympanites, may induce the rotation. Experience at the same time teaches that tympanites may exist without causing a torsio uteri in such an animal. Torsio uteri, as already stated, may occur at different periods of pregnancy. The causes are as yet quite obscure, although they probably depend on the same factor which produces torsion at a later period, viz., active movements of the foetus.

From an obstetrical point of view, torsion originating immediately before parturition is of most interest. The active movements of the calf toward the termination of pregnancy may produce changes in the position of the uterus on account of the lessened amount of foetal water, especially when the calf can brace against the rumen or that part where the rectus abdominis muscle is attached beneath the pubis (Mösching).

The conditions for the production of a torsio uteri are still more favorable when the cervix uteri has begun to dilate. At that time the uterus has contracted a little and is moulded on the calf. Most cases of torsio uteri therefore occur at that time, proven by the fact that in many cases found in the literature the os uteri was dilated after correction of the malposition, and occasionally a living calf was born.

It appears to happen once in a while that torsion occurs when the os uteri is closed, and after correcting the faulty state of the uterus, the hand cannot be introduced. Torsion may then produce circulatory disturbances, which produce uterine contractions—that is, labor pains. On removal of the spiral twist, pains cease at once or continue and effect dilatation of the cervix and parturition.

The origin of a torsion is to be confined in most cases to that time when the first pains occur. It is not reasonable that a rotation could exist for days or weeks and a live calf be born on correcting of such a state. Under such conditions there must be circulatory disturbances which endanger the life of the foetus and produce pains, or a torsion of long standing would lead to such changes that a reposition becomes impossible.

*Direction and Degree of Torsion.*—Rotation of the gravid uterus on its long axis may be to the right or left. Revolutions to the right predominate. By twisting from left to right, or, simply, right torsion, we understand a change in the position of the uterus, where the superior wall becomes the lateral wall and finally the inferior wall of the uterus. Left torsion represents the reverse movement. (Harms, Franck and others.)

When the upper wall has become the right lateral wall, it is a torsion of 90 degrees, or quarter torsion. Should the upper wall continue to rotate from here (right side), so that it becomes the lower wall, it is termed a torsion of 180 degrees, or half torsion. When now the upper wall of the uterus continues to revolve, until it reaches the left abdominal region of the cow—that is, becomes the left lateral wall of the uterus—the torsion is one of 270 degrees, or three-quarter torsion, to the right. After the upper wall has made these rotations to the right successively, and again regains its original position—that is, becomes the upper uterine wall once more—a torsion of 360 degrees, or a complete rotation to the right, has taken place. A torsion beyond 270 degrees will rarely occur, as it exceeds the limit of elasticity of the broad uterine ligaments, followed possibly by rupture. In the majority of cases resulting in complete recovery after untwisting the uterus, torsion at the utmost amounted to 360 degrees.

Rotation of the uterus renders the broad ligaments tense. Any revolution beyond 90 degrees contracts the cervix uteri.

Although the possibility cannot be denied that a revolution of the uterus itself may occur without involving the vagina, such cases must be rare. The vagina mostly rotates at the same time; on exploration per vaginam, spirals or cords the result of torsion are felt.

Circulatory disturbances in the vascular territory of the uterus may arise as a result of torsion; but they are limited when rotation does not exceed 90 degrees. The veins, on account of their thin walls, are the first to be unfavorably influenced; their lumen decreases and the return flow of the blood is interfered with. Since the uterine circulation is very

happily arranged on account of the enormous collateral branches in the broad ligaments, the influx and return flow of the blood is handicapped but little in a quarter torsion. This is quite different when the rotation reaches 180 degrees or more. Now disturbances follow, not equalized by collateral circulation. Venous stasis arises, and, in consequence of an excess of carbon in the uterine blood, contractions (labor pains), indicated by lively movements of the foetus at an early period, set in. A torsion of 270 degrees or 380 degrees, persisting for some time, prevents placental circulation and causes death of the foetus.

The above discussions are based upon a rotation of the uterus on its long axis.

Ehrhardt presents this opinion: "Rotation of the uterus takes place on its vertical axis, and therefore it would be better to speak of a *versio uteri*. At the moment of quarter torsion the foetus occupies a transverse position. When the foetus lies in a normal presentation, with the anterior portion of the body toward the pelvic inlet, then its head is in the direction of the right abdominal wall of the cow in quarter torsion."

Ehrhardt and Franck believe that most torsions of the uterus take place at an earlier period of pregnancy, although he admits that two factors are necessary for its production: 1. The uterus must have descended into the abdominal cavity. 2. The foetus must be sufficiently matured to produce rotation by its movements.

Mösching published a very interesting contribution on *torsio uteri* in the cow. We learn from his report, referring to 121 cows and one goat, that torsion occurred 88 times to the right and 34 times to the left. The termination was favorable in 94 instances, and mostly without complications.

*Symptoms.*—The symptoms of rotation of the uterus from the middle of pregnancy until the eighth month are often not recognized as such. Usually the diagnosis is colic. The cow kicks the hind legs against the belly, gets up and down and is very restless. The phenomena last about one day, when appetite diminishes, rumination may even cease, defæcation is

retarded, the faeces are more consistent than ordinarily, slight tympanitis is present. An observing attendant possibly notices straining, attributing it to attempts to pass the hardened manure. Torsion occurring in the fourth or fifth month is not followed by any other symptoms. Two or three days later the animal improves, begins to eat and ruminates and appears well. The whole process is even occasionally diagnosed by the professional man on superficial examination as indigestion and treated accordingly.

The rectal examination, which must never be omitted in a pregnant animal showing such symptoms, may at once explain such symptoms. On exploration, we detect the spirals of the twisted cervix uteri. A vaginal examination following it establishes the degree and direction of torsion. When pregnancy is more advanced, labor pains accompany the above named phenomena. These pains are the result of venous stasis in the uterus following torsion. These symptoms, quite persistent, as well as the uterine contractions assisted by the abdominal muscles, lead us to think of parturition. This ensemble furnishes a picture of *torsio uteri* immediately before parturition, so frequently seen, and therefore of great importance to obstetrics.

*Symptoms of torsio uteri at the time of parturition.*—Anybody who has met *torsio uteri* frequently in practice recognizes this condition in a cow by the history of the case. The attendant usually reports as follows:

"The time the cow should calve has come or passed by several days. Yesterday or the day before yesterday, I thought she was going to have a calf, as I saw symptoms, observed in the preliminary stage. The cow paddled behind, got up and down frequently, strained, rested a while and started anew, so that I expected her to find a calf at every moment. As yet nothing has shown itself, no *water-bag*, no *fætal water*. I believe that something is wrong."

The owner usually does not know whether the calf is still alive or dead. The examination reveals the following: The cow stands quietly, the udder is filled, the ligaments are either

partly or entirely sunk in; now and then pains, followed by long intervals of rest, are manifested. When called early the pains are quite intense, then later where the uterus has become atonic. After the necessary preparations are made, examination per vagina is practiced. In some cows we notice that the superior commissure of the vulva has retracted. On introducing the hand into the vagina, we feel, after passing the vestibule, that the further advance of the hand up to the os uteri is difficult. Under normal conditions the vagina is wide and the hand can be spread in it, especially in cows which have calved repeatedly. This is impossible in torsions. The vagina is twisted like a screw. In order to advance with the hand between the folds by allowing the fingers to follow the spirals the dorsal surface of the hand must be rotated until it becomes the lower surface of the hand, or, in other words, the palm is uppermost.

When a right torsion is examined by the right hand, the folds run from the superior wall of the vagina from left to right and obliquely forward and downward, or while the right hand is introduced in a state of pronation [palm downwards, W.] it arrives, when following the cords, at a state of supination [palm upwards, W.]. I use here the term "cords," as it comes closest to reality.

Saake very properly says that the expression, "spiral twists of the vagina and cervix uteri," is based more upon a subjective interpretation than objective observation.

In a right torsion of 180 degrees, two cords crossing each other are felt in front of the os uteri, the upper one running postero-anteriorly from left to right. In half torsion, the hand following the cords reaches the os uteri and usually enters the uterus. In rotations of more than 190 degrees, the cervix uteri cannot be reached any more; only in old cows with flabby, broad ligaments we may occasionally succeed.

The constriction of the cervix uteri, leading to the formation of those cords, is caused by the broad uterine ligaments. At half torsion both are rendered tense, allowing us to feel two cords on vaginal exploration. Quarter rotation only reveals one

cord, as only the broad ligament of that side toward which rotation occurred is tightened. In order to make a diagnosis the standing posture of the cow is preferable ; but, should we only wish to enter the uterus, the recumbent position of the cow is of advantage. In right torsion the animal is placed on the right side and the right hand employed in exploration.

[The following rule might be remembered: When the dorsal surface of the hand turns to the right, the torsion is to the right, or vice versa.—W.]

In consequence of the constriction and tension of the broad uterine ligaments, the flow of blood in the uterine artery is obstructed and should be followed by increased pulsations. The artery of that ligament which is tensest should therefore pulsate more strongly ; thus, in right torsion, the right uterine artery ; in left torsion, the left artery (Meyer.) Theoretically this is correct and would be an excellent diagnostic point to define the direction of the torsion. In practice, however, while feeling pulsations through the vaginal wall, it is only too often difficult to recognize whether the pulsations come from the uterine artery or not. Nevertheless, a strong pulsation or throbbing (Schmidt) on one side may lead us to surmise that the rotation occurred in that direction. This, together with direction of the cords, may complete the diagnosis.

The latter phenomenon is absent in a torsion of long standing. It is only met with in recent cases and in that respect may be a prognostic symptom of the greatest importance.

*Course.*—It happens occasionally that torsion is corrected spontaneously (Mösching). This rare termination may take place in rotations of 90 degrees, or, at the utmost, 180 degrees, occurring in the preliminary stage. Factors favorable to this spontaneous correction are : elevation of the hind parts, thus giving the pregnant uterus more room ; and active foetal movements. A rotation of 90 degrees may also be corrected by rupture of the water-bag, followed by partial evacuation of the foetal water and consequently room for retorsion (Göring).

Torsion of 90 degrees creates but little circulatory disturbance ; which is soon compensated by collateral circulation,

so that the primary uterine contractions soon cease, and should the end of gestation not yet be reached, a quarter torsion may exist some time without endangering foetal life. Rotations of 180 degrees give rise to circulatory troubles, followed by asphyxia and death of the foetus unless torsion is remedied in time.

The blood in the placentæ becomes laden with carbon dioxide when venous return flow is interfered with. By it the nerve-centres of the uterus become irritated and pains set in. When this torsion is relieved by proper treatment, the cause of the pains is removed and gestation may run its normal course (Felder, Baer). Abortion often follows.

Felder describes a case where torsion in the thirty-fourth week of pregnancy was removed by rolling the cow, followed by birth of a living calf in five and one-half weeks.

In torsion of 180 degrees or over, where the normal condition is not established, pains cease in two or three days; the uterus is exhausted; appetite, unless previously diminished, is absent, and symptoms of peritonitis are noticeable. The calf mummifies, as air is excluded. Should many manipulations have been practiced to effect detorsion, so that the foetal envelopes are ruptured, the foetal waters partly escaped and air enters the uterine cavity, decomposition of the calf sets in and it becomes emphysematous. In consequence of this, septic metritis and metro-peritonitis, as diffuse phlegmonous states, with fatal termination within six to ten days, set in. A high degree of torsion often terminates in rupture of the broad uterine ligaments or rupture of the uterus. As a consequence of a hemorrhage, which often follows, death may occur within a very few hours.

When air is absolutely excluded in torsions of 180 degrees or more, a chronic peritonitis may set in, inducing adhesions of the uterus and adjoining organs.

*Pathological Anatomy.*—Post mortem examination made on a cow, which died as a result of torsio uteri, reveals the morbid changes of a peritonitis and the malposition of the uterus. The former may have had an acute course—that is, of the

character of aseptic peritonitis—or a subacute one, with exudations between the folds of the uterus first; next, formation of young connective tissue, leading finally to adhesions. In the former, decomposition of the foetus and its distention by gas formation are common. In subacute peritonitis the calf is often not decomposed.

In the abdominal cavity an exudate, either sero-hæmorrhagic or sero-fibrinous, is always found.

When septic peritonitis leads to septicæmia, the cadaver soon decomposes, and besides the symptoms due to dissolution of the blood, enteritis and pleuritis are present.

In rupture of the uterus the lower wall of the cervix uteri is usually torn off and a part of the foetal waters mixed with a great deal of blood are contained in the abdominal cavity. Occasionally the calf is found within the latter.

*Prognosis.*—A torsion, occurring toward the end of gestation, must be judged as to its degree and length of time during which it existed. Torsions up to 180 degrees are more favorable than those exceeding it. A living calf is a favorable indication for a happy termination. A torsion of two or three days' standing, where the owner and others have made repeated explorations, should be prognosed unfavorably.

Although experience teaches that the termination is usually more favorable than imagined (of 121 cases in Mösching's statistics, 94 were corrected), a careful prognosis nevertheless is indicated.

Torsio uteri does not seem to predispose an animal to the same condition in future pregnancies.

*Therapeutics.*—The treatment endeavors to remove the torsion. Many methods are employed. Every practitioner prefers the one giving him the best results, and justly so. Any thinking man must admit that a standard method is not applicable to every torsion, and when one is unsuccessful, another one should be practiced. In fact, every case must be criticized separately and that treatment employed which is apt to yield the best results in the case under consideration. I discuss the treatment here under two heads:

First, the preparation; and secondly, the removal of the abnormal position.

*Preparations.*—For the experienced practitioner this enumeration is superfluous; he knows the difficulties under which the obstetrician labors, and he considers anything which will be of assistance or disadvantage to him. But for the sake of the beginner, not yet experienced, I shall discuss those points more fully.

In crowded stables, with little space behind the cow, a proper examination cannot be made. Some owners (especially the small breeder) often raise objections to move a cow well advanced in pregnancy, and prefer to have the veterinarian examine her then and there. The veterinarian, to avoid difficulties, submits to the wishes of the owner, and examination and treatment begin under adverse circumstances. Should this be followed by an unfavorable termination, he can hardly fall back on the objections raised by the owner, as the case should have been treated by the attending surgeon according to the rules of the veterinarian. Therefore, the first condition is *sufficient room*. No attention should be paid to such remarks as, "It is impossible; the cow might catch cold," etc., but tell the owner that a thorough examination is to his own interest and that treatment under favorable circumstances has a great tendency to bring with it good results. While at first a little provoked, he is apt to appreciate later the firm stand of the veterinarian, which after all enhances his reputation and standing and is much better than yielding concessions which interfere with the proper execution of the operation. Ample room is requisite, as we shall see, both to roll the animal and to execute other methods.

After washing and cleansing the vulva, tail and neighboring parts, and also washing and oiling the arm of the obstetrician, the examination is started, on the results of which the method to be applied depends.

Repeated explorations, rough palpation, are out of place, but a calm, careful local examination is practiced, at the same time interpreting the discoveries made by the hand, combining

them with the history of the case. Next the treatment proper begins.

*The correction of the abnormal position* may be done in two ways :

1. By rotation of the cow after previously fixing the calf and uterus.
2. By rotation of the uterus and calf.

The latter may be done from (a) the vagina ; (b) by detorsion after laparotomy.

No matter which method is employed, we must always remember that elevation of the posterior extremities greatly assists in the removal of such an abnormal condition. While speaking of spontaneous retorsion it was mentioned that the evacuation of the foetal water may have a favorable effect. Therefore, whenever possible, the foetal envelopes should be ruptured by hand. By reducing the volume of the uterus, room is gained and retorsion may become easier.

#### I.—ROTATION OF THE COW.

The purpose of this method consists in placing the uterus in a normal position, by rotating the mother in the direction of the torsio uteri. Thus, in right torsio uteri, the cow is rolled over to the right. In many cases the uterus rotates at the same time, making retorsion impossible. Only when uterus and calf remain stationary can torsio uteri be remedied by rotating the mother on her long axis.

Rotation of the cow is executed as follows : In right torsio uteri the cow is placed upon the right side, or we wait until she does so herself. Should she retain the standing posture too long, she may be thrown carefully. The fore legs and hind legs are secured, but not all four feet tied in a bunch. After elevating the hind quarters by pushing bundles of straw under it, rotation may begin. The bundles of straw are best made by laying one-half of the straw with their heads one way and the other half in the opposite direction, in order to secure a bundle of uniform thickness. Each bundle is tied up with three ropes to prevent the cow from gliding off it, which occurs when ordinary bundles of straw are used.

While some assistants roll the cow from the right side upon her back, the obstetrician introduces the clean, well oiled hand into the vagina and attempts to follow the folds as far as possible.

In torsion of 90 degrees to 180 degrees he even succeeds in entering the uterus, and the possibility exists to fix some part of the calf and in this way retain the uterus and calf while the assistants roll the cow. After the cow is rolled on her back she is rotated until lying upon the left side. The obliteration of the spirals is immediately perceived by the hand in the vagina, provided retorsion is successful. In quarter and half torsion this rotation is mostly sufficient, especially when the cervix uteri is open and the hand can be advanced and hold the calf in position.

In order to assist the obstetrician in the attempts to fix uterus and calf, pressure should be exerted upon the calf along the flank.

Torsions of 360 degrees or more do not allow the hand to enter the uterus or fix the calf. Felder, in such cases, tries to get hold of the foetus through the wall of the vagina, he looking upon this as the vital point in rotating the mother. Whenever this method is practiced great care is required, as the uterus may be ruptured.

When the calf and uterus rotate with the cow—frequently the case in large calves—rotation in the same direction must be repeated, while the exploring hand attempts to reach the uterus.

In some descriptions repeated rotations of the cow are spoken of; for instance, from the right side, over the back, onto the left side, over the belly, again to the right side, etc. In fact, we may achieve our purpose in this manner. At the same time I believe that such continuous rotations ought only to be practiced when the hand cannot enter into the uterus.

I succeeded several times in correcting a half torsion as follows: In half torsion to the right I place the cow upon the left side, and permit the hand to follow the spirals into the uterus. After tying the fore and hind legs separately, the cow is rolled

on her back. As a rule, calf and uterus rotate at the same time. Now I endeavor to render the calf immovable; the cow is quickly rolled back onto the left side and allowed to rise. In some cases detorsion is obtained provided the hindquarters are well elevated.

Any doubts regarding the direction of the torsion are easily dispelled by rolling the cow. When the vaginal constriction increases or decreases by rotation, the rolling in the first instance is in the wrong direction and in the latter in the right direction. Beginners may in this manner confirm their diagnosis.

For this purpose the cow is placed upon the right side, the fore and hind legs tied separately, the posterior extremities being raised. The right hand in the vagina follows the folds, while the cow is rolled on her back and then slowly on the left side. Any increased pressure upon the hand and arm after such a rotation shows at once that the cow is rolled in the wrong direction and that rotation is to be practiced in the opposite direction.

Guillod states that the obstetrician should roll over instead of the cow. By following the spirals with the hand and rolling from the abdomen upon the back, the uterus may be entered. His method was effective in ten cases where he rotated the cow in vain.

Rotation of the cow is one of the oldest methods and was mentioned already by Rychner in his "Bujatrik."

Another method of treatment consists in rotation of the uterus and calf. The cow may be left in the standing or recumbent posture. In this method detorsion is either practiced from the vagina or uterus, or by first performing laparotomy.

#### DETORSION FROM THE VAGINA AND UTERUS.

This method has many advantages over rotation of the mother. It may be executed in two ways: in the standing and recumbent position of the animal. But I wish to emphasize the fact, that this method can only be successful when the hand can enter the uterus; that is, in torsions of 90 degrees to 180

degrees, when the cervix uteri is dilated, or, in other words, in torsions originated in the preliminary stage of parturition.

When this method is to be practiced in the recumbent position, the cow is placed on her back and the hindquarters are raised. While following with the hand the spirals in the vagina, one endeavors to enter the uterus and to get hold of the head, or, in a posterior presentation, the hind legs. After rupturing the envelopes and partial evacuation of the foetal water, we grasp in a right torsion the head or legs of the calf and push them to the left and upward.

Should the hand succeed in entering the uterus sufficiently far to reach the shoulder of the calf, it should be placed against it and pressure exerted to the left and upward. In most cases we notice that this displacement is followed by a decrease of pressure upon the arm, and on retraction of the arm sufficient space is present to draw the fore legs or head into the genital passage.

Should torsion persist after the hand is withdrawn, it frequently recovers spontaneously, as soon as the head is driven into the pelvic inlet.

Darreau manufactured an instrument which he called "rétrouverseur uterin." It consists of three rods, three cords, a winch and screw. By means of it the head and fore legs of the calf are secured and counter-torsion attempted. The instrument shall replace the hand. I believe that in cases where the head and fore legs of the calf can be reached, just as good results are obtained by any of the other procedures.

Retroversion in the standing animal has found many admirers lately on account of its simplicity and success. According to P. Knüsel, forty years ago the veterinarians J. and B. Kamer, in Arth and Küssnacht (Canton Schwyz), applied this method.

As previously stated, this method is only applicable when parts of the calf are within reach of the hand in the uterus.

The larger the calf, the more the uterus descends, the greater its execution. Knüsel reports a successful detorsion from the vagina in 80 per cent. of all cases.

*Procedure.*—The cow is elevated behind, or if convenient the ground may be removed in front of her, so that the floor is lower in front than behind. While following with the hand along the folds an attempt is made to get into the uterus, envelopes are ruptured and the hand is rested against the neck or shoulder of the calf. While pushing the calf in a direction opposite to which torsion took place, the abnormal position may be removed. For this purpose the calf should be pushed as much as possible against the opposite wall of the uterus. Retroversion by means of the hand and arm from the vagina and uterus in the cow is a method which has been tested by many veterinarians, and can be recommended on account of its good results (Knüsel, Felder, Ehrhardt, Bühler, Holder). At the same time it calls for considerable force and some practice. In torsions of 90 degrees to 180 degrees this method is preferable to others.

The reposition by means of the hand from the vagina may, when necessary, be combined with rotation of the mother. Many variations may be tried, but it must always be observed that the hind parts are raised, as it assists greatly in detorsion. The favorable results of retroversion in the standing posture with elevation of the posterior extremities must be mainly attributed to this circumstance.

Göring described a very advantageous procedure, but only applicable to those torsions where the hand can be introduced into the uterus. He places the mother into a dorsal position. While he tries to enter the uterus by following the spirals the animal is rolled to the right and left in order to detect in which direction the hand progresses best. That position giving best results is finally retained. After the foetal membranes are ruptured, the foetal water evacuated, he draws one or both legs into the vagina. These are secured with loops and returned into the uterus. Now the head is brought into the genital canal, the lower jaw is looped or fixed by hooking an eye. Two men now draw the head gently into the spirals, leaving it here five to six minutes. He next brings the previously looped legs into the vagina, first one and then the other. After head and

fore legs have entered the pelvis, traction is alternately exerted upon the fore legs until they are extended, and parturition is completed by a few vigorous pulls on all ropes.

This method of extraction, as practiced by Göring, must be executed carefully, and severe traction is to be avoided. Some practitioners will not practice any traction until detorsion takes place, in order to avoid injuries (Saake).

Albert puts the cow into the dorsal position, pulls her up by the hind legs about two and one-half feet and supports the back and sacrum with bundles of straw. In consequence of the elevated position of the posterior extremities the uterus gains a good deal of room and the hand often advances further. By exerting pressure from without upon the calf and in a direction opposite to the torsion, retorsion may be effected.

#### RETROVERSION FOLLOWING LAPARATOMY.

This method can only be employed when all other methods fail. A small percentage therefore remains for this operation, the results of which are not too encouraging, to judge by reports (St. Cyr and Violet). No wonder, as this operation usually follows varied manipulations and often brutal interference. In most cases the owner has already the intention to slaughter the animal and finally permits the operation, on condition to kill the animal as soon as fatal symptoms manifest themselves.

The purpose of this procedure is to return the uterus and calf into a normal position from within the abdominal cavity. It consists of a bloody operation (laparotomy) and in retroversion. The field of operation is in the right flank. Although the upper region of the flank, in consideration of future healing of the wound, would be the most favorable site, as here a hernia is less liable to occur, retroversion is exceedingly difficult at that part, so that it is better to incise further down. With regard to the execution of the operation I refer to page 215.

The wound in the abdominal wall, having a length of 20 cm., should run obliquely downward and forward in the direction of the fibres of the internal oblique muscle.

After the incision has been made the operator enters with the carefully cleansed arm into the abdominal cavity, acquaints himself with the direction of the torsion and whether ruptures are present or not. This examination must be made exceedingly carefully, to avoid being accused of producing injuries already existing.

In right torsion the right hand of the operator penetrates between the uterus and lower right abdominal wall and attempts to reach beneath the uterus the linea alba, or, if possible, the left side of the uterus. When successful he grasps there a leg of the calf and the uterus, pulling it gradually in his direction, at the same time raising the uterus. These manipulations are materially aided when an assistant at the same time presses against the left lower abdominal region, or when the belly is raised by means of a board (Franck). In left torsion, the hand is allowed to glide over the upper face of the uterus to the left side as deeply as possible ; there parts of the calf and uterus are secured and thrown toward the operator.

A well instructed assistant, whose hand is in the vagina during the operation, can feel immediately when retroversion is successful, as his hand can then pass by the spiral folds. He may also assist in further retroversion.

Retroversion from within the abdominal cavity is a herculean task, and it is not always possible to twist a weight of occasionally 70 to 80 kg. with one hand ; at the same time as much as possible of the uterus and calf must be raised in order to pull on it carefully (Franck).

*Prognosis.*—When the operation takes place on the second day and the genital passages have not been injured by rough or unskilled aid, this method may be successful ; but when the owner waits three or four days and symptoms of peritonitis are noticeable, prognosis is exceedingly unfavorable, especially when after laparotomy a greatly distended uterus from an emphysematous foetus is revealed. Such cases are fatal.

Retroversion after laparotomy is a very good method and successful in many instances when the operation and reduction occur in time and no disturbances exist from previously applied

methods. There is no reason to fear peritonitis provided the operation is artfully performed; reduction also is not always as difficult as one may think. Franck, Göring, advise to make a close examination of the genital passage, before operating, in order to convince ourselves whether the animal has been abused previously or not. This is excellent advice and may save the veterinarian disagreeable moments, as the owner may later blame the operation for any accident which might follow it.

After completing retroversion, the abdominal wound is stitched and treated, as discussed further on. Explorations to see whether parturition is possible should immediately follow the closing of the wound, and as a rule the hand can enter the uterus and reach the calf. Parturition ought to be brought to a close as soon as possible, but without too much traction, remembering eventual injuries which might have occurred during retroversion.

Whether the os uteri is open or closed after retroversion depends on the time during which torsion took place. In torsion occurring at the time the cervix uteri dilated, the os uteri is almost wide open after detorsion. Pains and the mechanical action of the water-bag then take care of complete dilatation, so that parturition may be done successfully. This is the usual course in practice.

When torsion occurs a few days before the end of gestation—that is, with a closed os uteri—pains, the consequence of a disturbed circulation, manifest themselves. After reducing the abnormal position, the os uteri is found impervious. Now two possibilities exist: The pains cease, as the cause, the disturbed circulation, has been corrected, and in due time normal birth follows, or the pains continue and the cervix uteri opens after a while in the ordinary manner.

Felder reports two cases of the first kind. The one happened in a cow where torsion was corrected by rolling the animal and fixing the calf through the vaginal walls. Five weeks and a half later she gave birth to a healthy calf, enjoying good health during all that time.

In the other case of torsio uteri, the hand could only be passed into the uterus with difficulty. After successful retroversion, nature was allowed to take its course. Fourteen hours later parturition took place without any special aid.

How shall we proceed, when the os uteri is still closed after detorsion?

When the ligaments are sunk in, and the udder full, so that everything points to an early parturition, we should not be in too great a hurry to forcibly dilate the os uteri. Cautious dilatation by rotary movements with the finger do no harm. Incisions are to be avoided unless the os uteri is obliterated. As regards the latter, I refer to page . It is much better to modify the excessive activity of the abdominal muscles by giving chloral hydrate per os or per rectum; the latter is preferable.

Another examination made in a few hours usually detects some dilatation. As long as the calf lives, we may wait for a sufficient dilatation.

In cases where dilatation of the cervix uteri succeeds retroversion, and the water-bag can be felt with the finger, nature is permitted to take its course, and assistance rendered where necessary.

When torsion has existed for some days or longer and the foetus is dead, insufficient dilatation of the cervix often follows retroversion. Should the pains be feeble and the foetal water partly evacuated, the immediate mechanical dilatation of the cervix uteri becomes a necessity (see page

## 2.—Abnormalities in the Parturient Passages.

As : pelvic constrictions, morbid alterations in the cervix uteri, abnormalities of the vagina and vulva.

### PELVIC CONSTRICTION.

While discussing pelvimetry it was stated that the normal dimensions of the pelvic inlet and passage are definite in character; it was further remarked that the dimensions of the foetus

must correspond with the diameters of the pelvis, in order to have natural parturition. A pelvic constriction, quite frequently observed in practice, is found in the juvenile pelvis.

It is occasionally met with in two-year-old heifers, in primiparæ; that is, at an age when they bear young the first time. This pelvis is laterally constricted, especially in the lower half. Relations between the transverse and vertical diameter of the pelvic inlet may be normal, but the distance between the pectineal tubercles, and especially between the two cotyloid cavities, is lessened. As a consequence the pelvic canal is narrow and renders the passage of the calf difficult.

*Symptoms and Prognosis.*—In this pelvic constriction, the head, resting on the fore legs, passes the pelvic inlet, but the withers and shoulders do not enter the pelvis. Parturition has advanced to that point where the head and fore legs, the latter slightly retracted, are visible at the vulva. Should the act of birth have lasted already several hours, the foetus is mostly dead and the swollen tongue protrudes from the mouth. The attendant, as a rule, has practiced extraction unsuccessfully and the veterinarian on arrival finds head and legs firmly wedged in the pelvis.

The calf in itself may be of normal size, but is relatively too large for the pelvic dimensions of the mother.

The prognosis as regards the calf is unfavorable. It is rare to see the calf live after extraction, provided it can be removed as a whole.

With regard to the mother, the prognosis is more favorable, unless the attendant exerted powerful traction. It can be said that in general such a heifer stands a forcible extraction astonishingly well.

At this age the pelvis is not yet completely ossified, being slightly dilatable. Stretching of the symphysis at that age in the heifer is more quickly repaired than in the adult or old cow. Many owners, who never permit severe traction on the calf, base their experience on the extraction of a calf in a young cow by five or six men. The juvenile pelvis does not interfere with

future parturitions. The relative dimensions of the bovine pelvis already at an age of three years possess much more favorable proportion for birth, when nutritious food rich in lime salts has been fed.

*Therapeutics.*—It is desirable to prepare as much as possible the dilatation of the parturient passages, so matters may not be made worse by disturbances of the soft parts, as, for instance, insufficient opening of the cervix uteri. The amount of traction which may be applied must not exceed the force developed by three men at the utmost. In an anterior position, with the head resting upon the fore legs, alternate traction may be exerted upon them to get the shoulders out of the way and thus decrease the bicostal diameter. When half of the calf is born, its trochanteric diameter is rendered parallel with the vertical diameter of the pelvis, by rotating the calf on its side. On a posterior presentation, with the hind legs in the genital passage, the trochanteric diameter of the calf is made to enter the pelvic inlet obliquely, its passage being assisted by alternately pulling on the hind legs, thus decreasing the distance between the calf's trochanters. See also page 186.

*Unilateral* or *bilateral* depression of the sacrum causes narrowness of the pelvic cavity. Stockfleth describes a case where the displaced wings of the sacrum and the posterior iliac spine had become united by strong connective tissue. In bilateral depression or complete sacro-iliac laxation, the height and width of the pelvic inlet decrease. An irregular callus following a fracture may also lessen pelvic dimensions. The most important fractures are: Fracture of the internal angle of the ilium and subsequent unilateral displacement of the sacrum; fracture of the posterior angle of the ilium and fracture through the symphysis. Exostoses also may lead to constriction of the pelvis. The rachitic pelvis of a two year old heifer greatly resembles the juvenile pelvis; the distance between the cotyloid cavities is diminished. These abnormalities of the pelvis may seriously interfere with the act of parturition, but they are rare in the cow. This is due to the fact that cows with such abnormalities are rarely bred and are usually rather slaughtered

by the owner than given a chance for an eventual recovery after such a fracture.

The treatment depends on the degree of constriction. When the pelvic dimensions are but little reduced, total extraction may be possible, while a foetus relatively too large makes such a procedure impracticable. For further information, I refer to the chapter on excessive development of the foetus.

#### MORBID ALTERATIONS IN THE CERVIX UTERI.

The cervix uteri forms the connecting link between the vagina and uterus. Before dilatation it is firmly closed, the transverse folds of the utero-vaginal mucous membrane, *palma plicata*, lie so closely together that the finger cannot pass into the cervical canal. During natural parturition the cervix uteri dilates to such an extent that uterus and vagina form a continuous canal.

Pathological states met with in practice preventing complete dilatation of the cervix are: Spasm of the circular muscular layer, total or partial obliteration and tumors.

Spasm of the circular muscular layer is less frequent in practice than is ordinarily stated. The question has been raised whether it is possible that a tonic spasm could create a closure sufficient to resist the boring movements of the finger or hand. We must admit that muscular contraction in itself does not suffice, but may do so when assisted by other factors.

The cervix uteri is composed of a plicated mucosa, necessary for an eventual dilatation; further, a submucosa and a serosa. The muscularis consists of a strong inner layer, the fibres of which are circular and extend to the beginning of the vagina; further, an external horizontal layer, ending in the vagina. Between these layers numerous blood vessels and nerves are found.

The cervix uteri of the cow is physiologically rigid. As a result of the infiltration taking place with the first pains, this rigidity diminishes and may be overcome by mechanical pressure from the uterus.

We have seen that dilatation of the cervix uteri during natural birth was produced by two factors—contractions of the uterus and pressure of the water-bag from within the uterus. The former dilates the cervix somewhat and as a consequence the accessory placentaæ become detached around the internal uterine opening, so that the separated chorion is driven against the internal opening of the uterus by the uterine contractions. The folds in the cervical canal run from before to behind, so that dilatation must take place from within the uterus, and not vice versa.

When the os uteri is opened a little by the earlier pains, further dilatation is affected by the water-bag. Should the cervical canal remain closed on account of the spasm, the second factor remains useless and dilatation of the cervix with the finger is rendered difficult on account of the anatomical arrangement mentioned above. Should the spasm subside after the uterus is exhausted (atonia uteri) the second factor of mechanical dilatation is wanting.

*Symptoms.*—The veterinarian is usually called after the act of parturition has persisted for some time and the owner's patience is exhausted, as neither the water-bag nor "waters" appeared. The ligaments are depressed, the udder full, the vulva edematous; in fact, approaching birth is announced. Even strong pains have been noticed. On exploration, the vaginal portion of the uterus is distinctly felt, but the cervix is closed. The calf in consequence of the uterine contractions and difficult placental circulation, may be dead, but usually is alive. Boring movements with the finger in the cervix are not very successful, as one or two fingers may be introduced after a great deal of trouble.

*Therapeutics.*—The activity of the abdominal muscles in spasm of the cervix is much more intense than the pains. To all appearances the cow is able to strain violently, while the uterine contractions are in fact weak. When premonitory symptoms are present, the ligaments sunken, the udder filled, the vulva swollen, assistance must be rendered immediately. As a rule, already the owner waited too long.

Formerly the os uteri was dressed with an ointment consisting of extractum belladonna and adeps suillus 1:4; some used soap instead. These remedies are mostly unreliable. A clyster of chloral hydrate per os has been recommended to modify the excessive activity of the abdominal muscles. Straining is thus greatly decreased and the danger of rupturing the uterus lessened. Many advise to douche the vagina every two hours with warm water (40° C.). This practice has been followed by excellent results.

Reichenbach gives warm irrigations of flaxseed gruel and camomile tea; orders spirituous liniments to the lumbar region, warm clothing, and internally twice daily a pint of warm wine; he positively prohibits vaginal explorations by the attendant.

When the os uteri after some time dilates sufficiently, so that two fingers may enter, further dilatation may be effected by means of rotary and boring movements of the fingers and hand. When the foetal membranes are filled with the "waters," enter the cervix, they must not be ruptured, but left to produce further dilatation. Incising the cervix or mechanically opening the cervix are to be avoided.

[In two cases of spasm of the cervix uteri good results were obtained by chloroforming the animals.—W.]

Spasm of the cervix uteri, as an obstacle to parturition, is rarely met with. This condition is often but erroneously supposed to be met with, but at a time when parturition is yet out of the question,—that is, during false pains. The latter may manifest themselves some days, even weeks, before birth occurs.

They consist of feeble uterine contractions, supported by severe straining, all of which resemble labor pains. Since they occur at a time when preparations for parturition are yet wanting, the udder flabby, the cervix closed, the ligaments tense, they are termed false pains.

The *aetiology* of false pains is yet unknown, although it is reasonable to presume that they depend on disturbance in the blood supply of the gravid uterus.

*Symptoms.*—A few days or two or three weeks before the termination of pregnancy, certain phenomena become manifest,

otherwise seen only at parturition, and interpreted by the attendant as belonging to approaching birth. The pains have lasted for one or two days, appetite is diminished, rumination ceased, but straining persists.

Examination finds the cow in the above mentioned state; the ligaments are not depressed, the udder empty, the cervix closed, the calf is alive and the cow continuously strains—so much so, that the rectum may prolapse; the temperature is normal or slightly elevated, the pulse increased in frequency. Under these circumstances one deals with false pains in no way connected with parturition. The supposedly insufficient dilatation and difficult parturition from it causes the owner great anxiety. Most owners, in spite of all explanations, believe firmly that these pains should be followed by parturition.

Some years ago I was called to a breeder, whose cow had been in pains the whole day, although she was not due to calf until three weeks later. On my arrival I found the above mentioned symptoms; the calf was living. This man was utterly astonished when I assured him positively that parturition was entirely out of the question here, while he was prepared for the worst. Since I had done his work successfully for years, he complied with my request, although reluctantly. The cow was rubbed well, covered up nicely, and received chloral hydrate per os. Straining ceased after a few hours, and twelve hours later the cow was well. Three weeks after this she gave birth to a living calf without assistance.

*Prognosis* may be quite favorable, although there is danger of rupture of the uterus. It is therefore well to be guarded when making a prognosis when the animal is far advanced in pregnancy, as serious complications may arise.

*Therapeutics*.—Elevation of the hind parts of such an animal is very desirable; in many cases this is followed by improvement. The administration of chloral hydrate either per rectum or per os is followed by very good results; large doses of bromide of potassium, bromide of ammonia, bromide of sodium, can be recommended. Some recommend opium preparations. But the stage of excitement, preceding depres-

sion, is of disadvantage in such cases. A very simple and effective means consists of placing a pillow filled with warm hayseed upon the lumbar region.

#### PARTIAL OR COMPLETE OBLITERATION OF THE CERVICAL CANAL.

By it is understood a partial or complete closure of the cervical canal or part of it, so that during birth no dilatation of the cervix uteri occurs.

The causes of this atresia of the os uteri, as it is termed at times, may be: Retraction from cicatricial tissue following injuries. When in previous pregnancies labor was difficult and an extraction resulted in severe injuries to the cervical wall, a great deal of granulation tissue may follow, contracting later and forming scar-tissue. It happens that excessive traction during insufficient dilatation is followed by rupture of the os. During recovery the cervix is slow to close, so that conception may take place before the parts are healed. A cervix destroyed in this manner regenerates by young connective tissue, which, contracting later, seriously interferes with dilatation of the cervix at parturition.

Cartilaginous degeneration mainly due to a deposition of calcium salts, is occasionally, but, happily, seldom, observed. In this condition dilatation of the os uteri is impossible.

Certain anomalies occurring during foetal development (due to an insufficient union of Müller's ducts), resembling fleshy bands, may be found lying in front of the os uteri.

Adhesions between the walls of the cervical canal have been observed (Göring).

Tumors of various dimensions now and then cause obliteration of the cervix uteri, as fibromata, leiomyomata and carcinomata (Lucet, Wilhelm).

*Symptoms.*—In such animals everything is prepared for parturition. It sometimes happens, when the broad uterine ligaments and perineal fascia are relaxed, that in consequence of the violent pains, assisted by the abdominal muscles, the upper wall of the vagina and the closed os are pushed backward until they appear between the labiæ of the vulva. Vag-

inal examination then reveals that the upper wall of the vagina is drawn tightly over the head of the calf.

Especially when such a case is met with for the first time, it is looked upon as a most peculiar condition. The obstetrician feels a fold, and behind it the calf, and is at a loss to account for this phenomenon. But the os uteri, occupying the centre of the whole, explains the situation.

It is not always easy to diagnose the nature of an obliteration. In some cases it is possible to enter the uterus with one or two fingers, in other cases the os is so tightly shut that not even a single finger can be passed. Tumors and anomalies of embryonic origin are much more readily recognized.

*Prognosis.*—When an obliteration is positively diagnosed to be due to cicatricial tissue or cartilaginous degeneration, prognosis is unfavorable. Parturition of course may take place after forcibly dilating the parts, but such a procedure is always dangerous. Such dangers may be greatly modified by careful after treatment, which is often neglected when executed by an attendant. The bloody dilatation known as *hysterotomia vaginalis* is described under obstetrical surgery.

*Therapeutics.*—Should any doubt exist as to the diagnosis, the various measures suggested under spasm of the cervix uteri may be tried. It is always advisable to attempt dilating the os uteri by boring movements with the finger. *This requires much patience.* I remember to have spent once two hours before I was able to pass two fingers into the cervical canal. One hour later I could pass the hand, and after two more hours, working altogether five hours, extraction took place.

The operation must be the last resource, when all other means have failed. The experienced practitioner does not take the knife too quickly, but he does not hesitate to use it freely when it remains the only means, after repeated futile attempts to relieve the condition otherwise.

*Sequels.*—The violent straining may be followed by a prolapsus vaginae or rupture of the vaginal walls. In the course of violent pains and energetic foetal movements the cervix uteri may become detached.

Unless proper aid is rendered the foetus soon succumbs. It is often astonishing how long the calf lives in spite of the disturbed placental circulation. When birth does not take place, the calf usually becomes emphysematous, as the repeated manipulations favor entrance of air. This is followed by a septic metritis and peritonitis, ending fatally within a few days.

#### ABNORMALITIES IN THE VAGINA AND VULVA.

In primiparae, rigidity of the vaginal walls is often observed. There are cases where it is difficult to pass the hand into the vagina, while the cervix uteri may be completely dilated. The diagnosis is easily made. The head and fore legs are compressed, the vaginal wall is tightly stretched. The greatest obstacle is met with at the junction of vagina and vestibule. This rigidity may depend on an insufficient infiltration of the pelvic organs and is at times observed in the partus præmaturus. The treatment strives to expand the lumen of the vagina and render easy the passage of the calf. At first mechanical dilatation with the hand is attempted. The well oiled hand is passed over the head of the calf and pressure exerted with the dorsal portion of the hand. This requires a great deal of patience, but is usually crowned with success on account of the elasticity of the vaginal walls. By pulling gently and steadily on the fixed head and fore legs dilatation may be effected, as the advancing body acts like a wedge.

If the vulva is too narrow and the muffle of the calf's head visible between the labiæ, we try to pull the vulva back over the head. For this purpose one hand on each side is placed against the inner surface of the vulva and forward pressure exerted while the calf is pulled in at the same time, thus pushing the labiæ over its head. Before beginning these manipulations, thorough lubrication of the parturient passages is necessary; even then patience is required and traction must be moderate.

Should dilatation of the vulva be unsuccessful in this way, and positively no other obstacles be present, incision may be made into the upper commissure. Three small incisions

suffice, one vertical and the other two slightly oblique, but all three must start from one point. This would require a strictly antiseptic after treatment to prevent puerperal infection. In most cases the vulva tears when traction is excessive and the opening too small. Thus the upper commissure and the skin of the labiæ is often torn when the limit of elasticity has been trespassed upon.

Faulty conformations of the vagina may interfere with the passage of the foetus. These are mostly the so-called fleshy bands or pillars which are simply incised (Harms, Kruijt).

Schiellerup describes a case, under the title of "Septa in the Vagina," in a cow, consisting of a cord two fingers thick extending from one vaginal wall to the other, interfering with parturition. Head and neck were lying above the fore legs below this cord. After the cord was cut birth took place. In another case reported by him such a cord retarded the expulsion of the foetal membranes. Parturition had been difficult; the foetal membranes were wrapped around the fibrous cord.

Vaginal tumors occasionally give rise to dystokia. Pedunculated leiomyomata, which can be removed in the ordinary manner, are most frequently met with. A diffuse infiltration of the vaginal walls by tumors is rarely observed. Pedunculated polypi, often attached to the os uteri, float in the vagina. They may be of considerable dimensions, as large as a child's head. Their removal does not result in serious hemorrhage (Lodolitersite, Völker).

In consequence of a traumatic vaginitis, *colpitis, traumatica*, following a previous dystokia, or, as occasionally seen in primiparæ, cicatricial tissue results, causing vaginal stenosis. In either case subsequent conception is possible and complete recovery appears to have taken place. Nevertheless, subsequent parturition shows that the elasticity of the vagina has been greatly diminished by previous deep inflammatory processes, and that the passage of the calf is rendered difficult. In all cases where the measures mentioned under "rigidity of the vagina" fail, total or partial embryotomy must be practiced.

In the parturient passages, another disturbance may occur, which not only seriously interferes with expulsion, but also endangers the life of the mother: inversion of the bladder, with prolapsus of the inverted parts into the vagina. This condition is very rare in the cow, as the bladder is firmly fixed by the strong, fibrous pubo-vesical ligaments. It is recognized in the vagina as a round, fluctuating tumor, about as large as two fists, urine dropping from its surface. The aetiology, symptomatology and therapeutics are discussed in "Special Surgery." Of course it is plain that the inverted bladder must be reduced and kept in its place. Should the inverted prolapsed bladder remain in the vagina, the passage of the calf would cause its rupture and death of the mother.

### 3.—Abnormalities of the Expelling Power.

In the expulsion of the foetus two factors are concerned: the contraction of the uterine muscle and the auxiliary movements of the muscles of the skeleton, known as abdominal pressure. Where one or the other factor is not sufficiently developed, the expelling forces become diminished, a condition termed *feeble pains*.

When the action of the uterine muscle is diminished in intensity, it is termed *atonia uteri*. This may be due to many causes: excessive distention of the uterus from hydrallantois, twins and emphysema of the foetus, by adhesion between the uterus and adjoining organs, the result of a previous peritonitis. Feeble pains may also be produced by paralysants, affecting the nerve centres of the uterus. Thus the uterine contractions are feeble and occur at long intervals in cows suffering with vitulinary fever either before parturition or at the time the cervix uteri dilates.

Abdominal pressure is lessened in hernia and pendulous abdomens. In the latter instance the uterus is in the state of anteversion, so that the expelling forces are acting in a direction extremely unfavorable to the passage through the genital canal. General weakness may also give rise to feeble pains.

*Sequel.*—As a result of weak uterine contractions the expulsion of the calf is retarded, and the possibility exists that the calf is but little advanced, so that parts of it do not reach the pelvic canal. With twins, the birth of the first calf usually takes place rapidly, while the second one is more slowly expelled on account of the decreased contractions; therefore the owner is often of the opinion that with the appearance of the first calf parturition is at an end, looking upon later pains as after pains, by which the foetal membranes are to be removed.

I have seen cases, where the owners, thinking parturition was finished, feared prolapsus uteri on account of the persistent pains. They used all sorts of measures to prevent it, as pinching the back of the cow, applying a truss, etc. In one case, where the owner apprehended prolapsus, I found to his astonishment the water-bag of a second calf in the vagina. After removal of the truss the second calf was born, eight hours after the first one. Feeble pains impeded expulsion.

As a second effect of feeble pains, the expulsion of the foetal membranes (*secundinæ*) is retarded. When discussing hydrallantois, I referred to it. In twin births the retarded expulsion due to diminished contractions of the uterus are also observed. In the chapter on prolapsus and *inversio uteri*, we shall see that feeble pains, together with strong abdominal pressure, readily give rise to an inversion.

*Symptoms.*—Feeble pains during parturition are recognized by the light pressure they exert upon the calf. The presentation may be normal, the parturient passages prepared, and still expulsion does not advance. The diagnosis is easily made on introducing the arm into the uterus. In many the dilatation of the cervix uteri is incomplete, partly due to the insufficient uterine contractions and consequently limited mechanical action of the water-bag.

*Therapeutics.*—Treatment is only of use in few cases; for instance, in excessive distention of the uterus; in those cases we can effect some uterine contractions. Success at the same time is but small, and it is much better to practice traction. Care must be taken to guide the force of the expelling powers,

especially abdominal pressure, in the direction of the parturient passages. This was emphasized when dealing with anteversion. During the process of involution we may attempt to encourage uterine contractions directly or indirectly, the former by irrigations with cold water, the latter by administering ergot of rye. Violent pains may disturb the normal course of birth and render difficult reduction of abnormal presentations. Although such pains seldom induce hurried parturition (*partus precipitatus*), they may lead to circulatory disturbances, even death of the foetus.

In many instances, when violent pains are mentioned, severe abdominal pressure is meant. During the process of involution it may result in prolapsus uteri.

*Therapeutics.*—In order to diminish severe straining, inhalations of ether, chloroform, morphine subcutaneously, chloral hydrate per os, as clyster, may be administered. A simple means to lessen straining consists in putting the cow on the back or in elevating the hind legs. Some owners tie a curry-comb to the back of the cow, or pinch the skin over the spinous processes of the lumbar vertebrae with tongues—brutal manipulations, decidedly to be prohibited.

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## II.

### ABNORMALITIES OF THE FETUS.

#### 1.—The Foetus Absolutely and Relatively too Large.

In either case the foetus is too large, rendering normal parturition impossible. The foetus absolutely too large may coexist with a normal pelvic canal; a foetus relatively too large represents a normally developed calf in a constricted pelvis.

The foetus absolutely too large may be out of proportion to all parts of the pelvis; but may be excessively developed in certain diameters, preventing its passage on certain places of the pelvis.

Excess of volume of the head, inherited from the father, is frequently observed. Bulls with massive heads are not liked, as experience teaches that the big heads of their calves often give rise to dystokia.

The excess of volume of the anterior extremity of the body mostly confines itself to an over development of the muscles of the shoulder and pectoral region. Such calves with wide breasts and fleshy shoulders meet with obstacles in the pelvic canal during parturition.

The so called square buttocks, "Büren-Hinterer," low German "Bärevert," Belgian "Cul de poulain," Hollandish "Paarden" or "Steenbil," are characterized by an extraordinary development of lumbar and gluteal muscles. The loins and buttocks form a rounded mass, arched on either side of the sacrum, so that its spinous processes lie in a groove. The tail is thin, while the bones of these calves are delicate and fragile. The distance between the external angles of the ilia is not too great, but the width between the trochanters forms a distinct obstacle to parturition.

By *double-enders* we mean calves with excessive muscular development of the anterior and posterior extremities of the body. They have a short, wide head, short neck, wide breast and fleshy shoulders. Back and loins are strongly muscular, so that the spinous processes lie in a groove. The muscles of the hind legs are greatly developed, the tail is thin. The bony frame of such calves is not proportionately developed to the muscles, the shin-bones are short, the diaphyses thin. They weigh from 50 to 80 kg. Such a double-ender, when born alive, is usually fattened and may weigh from 100 to 120 kg. at an age of eight weeks. During parturition, long, thin legs do not point to an excessively developed calf. But anybody engaged in obstetrics some time recognizes the double-ender at once by its short shin-bones with heavy epiphyses and thin diaphyses, expecting a tedious extraction.

*Course of Parturition.*—In anterior presentations, where the head lies upon the fore legs, birth advances until the head and fore legs progress into the vagina as far as the carpi. At

the moment when the withers come opposite to the pelvic inlet, birth is retarded. On examination the head is found resting on the fore legs, the calf's chin resting upon the claws. The latter is due to the fact that the elbows, on account of the fleshy shoulders, cannot enter the pelvic canal, and the anterior limbs remain a little behind. When chin and claws lie in the vulva at the same time, it is frequently an indication of an excess of volume of the calf.

Dilatation is mostly complete, preparation for both having extended over quite some time. In the posterior presentation, with the hind legs in the parturient passages, the posterior limbs have sufficiently advanced to protrude beyond the vulva at each pain; as a rule, one leg appears up to the fetlocks and about one-half of the metatarsal bone of the other. Parturition is difficult, as the trochanteric diameter exceeds the pelvic dimensions. The thin tail and the strongly developed gluteal muscles detected on exploration suggest the double-ender.

The owner always attempts to extract the calf. When in an anterior presentation he secures the fetlocks, and with the aid of other people an attempt is made to extract the calf. In some cases, where the cow is well developed and has a wide pelvis, extraction may succeed, but in most cases the calf is partly extracted, and when the withers are caught in the vulva, parturition comes to a standstill. The trochanteric diameter, as well as the distance between the patellæ, may be too great for the diameters of the pelvis.

In posterior presentations, with the hind legs in the parturient passages, the owner also pulls here, and often successfully. After the posterior extremities are once delivered, the anterior portion of the body rarely interferes with parturition.

But in many cases the attendant does not succeed in extraction, and the veterinarian is called in. When the excessive traction exerted by the owner results in fracture or luxation, the surgeon has a disagreeable task before him. Under such conditions the termination is unfavorable, as such animals remain in the recumbent position often for a long time. Should

the animal be still able to stand up on our arrival, the prognosis is more favorable.

*Treatment.*—With the foetus in the anterior presentation, we first acquaint ourselves with the position of the calf and conditions of the pelvic inlet. Head and fore legs are corded, the former by means of loop around the lower jaw, or a cord around the head, respectively, an obstetrical head-stall; the latter by loops above the fetlocks. The cow is fixed by placing a surcingle around the buttocks, securing it to the posts on either side of a stall. The dutch collar of a horse may be used to good advantage. The breast strap is put around the hind legs about 8 inches below the vulva, and the neck strap over the lumbar region, while the traces are either fastened or held otherwise. In this manner the cow is not displaced.

It has happened to me repeatedly that a cow was drawn out of the stall when traction was exerted by two men. This necessitates the removal of the cow to her first position before the obstetrical operation can be continued. Such an interruption is disagreeable to the obstetrician, and may be dangerous to the mother.

After placing the cow upon the right side and taking up the cords fixed to the head and fore legs of the calf, alternate traction is exerted upon the anterior limbs to reduce the bicostal diameter of the thorax shoulders, by the thickness of one shoulder. After the fore legs have been advanced to the extent that the chin occupies the middle of the metacarpal bones, traction is applied to the head. Each fore leg and head is turned over to one man. At the same time the force exhibited by three men must never be exceeded.

Care, of course, must be taken that the feet of the three men are braced, to prevent slipping and thus jerking the animal. Traction, moderate at first, is gradually increased, but must be uniform at all times.

Before extraction is begun lubrication of the parturient passages is necessary, and no doubt should exist that the cervix uteri is completely dilated.

Such extraction must be practiced with a great deal of

patience. Instances are known where eight to ten men extracted a calf and everything went well, but we must not set such brutal examples, the results of which are usually serious. Experience teaches, also, that eight to ten men do not develop much more power than three men, as they cannot be stationed properly to pull to advantage, and that the exerted force greatly decreases after a time.

How variable traction is, and its decrease, may be seen by referring to the following table :

FORCE EXERTED BY TRACTION (EXPRESSED IN KILOGRAMS) BY

ONE MAN.		TWO MEN.		THREE MEN.		FOUR MEN.	
At the outset.	After 45 seconds.						
112	100	200	100	324	150	355	150
97	10	195	175	200	150	275	175
70	55	125	50	...	...	225	175
60	60	100	60	...	...	...	...

The feet of persons who pulled were braced, their position was the same as in parturition of an animal in the recumbent position. The dynamometer was employed to measure the force exerted. After one minute the men showed decided fatigue, from which they quickly recovered.

When extraction is unsuccessful in this way, the calf is usually dead. Partial or total embryotomy is then indicated, an operation much less dangerous, when properly executed, than a forced extraction. (See p. 260.)

A huge foetus in the posterior presentation, with its hind legs in the parturient passages, when pulled at unsuccessfully by three or four men, is no reason why further extraction should be abandoned and embryotomy performed. The treatment should be the following: After securing the cow and

convincing ourselves that the cervix uteri is fully dilated, vulva and vagina are oiled and the tail of the calf is pulled to one side during extraction. The hind legs are corded at the fetlocks.

In many cases we can estimate on exploration the trochanteric diameter of the calf and the transverse pelvic diameter. An approximate mensuration by hand of the various dimensions enables us sometimes to decide upon the possibility of extraction. One man takes care of a hind leg. While both men pull at the same time, each on one leg, the obstetrician guides both ropes and takes care that traction is exerted in the right direction. When this method is unsuccessful, two men pull on one leg, drawing it out as far as possible. After the hock of the leg has thus passed beyond the vulva, and the fetlock of the other leg just projects at the vulva, the leg drawn out most is fixed by a man—that is, held in place to prevent its return. Now the other leg is extracted, and in many instances the trochanteric diameter slips obliquely through the vertical diameter of the pelvic inlet, and the posterior half of the body can be delivered. The cords are next attached above the hocks, traction is exerted on both hind legs, and parturition is finished. This method, often yielding good results, should always be given a trial. Where extraction does not succeed, partial, or total, embryotomy must be performed.

*The fœtus relatively too large* exceeds the dimensions of the pelvic canal. The calf may be normally developed, but is too large for the constricted pelvis. We often see it in primiparæ, the two-year-old heifer. The only obstacle in such a juvenile pelvis lies in the decreased diameter between the cotyloid cavities. At the same time it may happen that the calf is absolutely too large. On account of the small head and fore legs lying in the vulva, the owner imagines the calf of ordinary size, and often exerts violent traction. In some cases he is successful; in many cases the calf is only born as far as the withers, as the trochanteric diameter cannot pass the pelvic inlet or pelvic canal. We are often told in practice that at such

and such a place eight to ten men pulled and successfully delivered a calf. This is due to the great elasticity of the foetal pelvis as well as that one of the heifer not yet completely ossified, and therefore capable of some distention.

The treatment is the same as in the foetus relatively too large. When the anterior half of the calf is born, and excessive traction previously practiced, embryotomy may be performed immediately, consisting in the removal of the anterior extremities of the body, evisceration and reduction of the pelvis. Some practitioners, after dividing the foetus, rotate the hind legs and pull them into the pelvic canal, where they may be extracted or one leg removed.

This is fully discussed under embryotomy. In cases where the anterior portion of the calf has been born for several hours, while the hindquarters are still in the pelvic canal, prognosis after termination of birth is not favorable. The mechanical dilatation of the parturient passage may be followed by reflexory paralysis, in consequence of which the cow never rises or only after a long time. The tension of the vaginal walls may produce circulatory disturbances and gangrene.

## 2.—Emphysema of the Föetus.

*Definition.*—We understand by this designation a foetus decomposed within the uterus, the gases of such a decomposition causing a general emphysema; being of a subcutaneous, intermuscular and subserous type.

*Ætiology.*—The foetus may die at any time of the period of pregnancy. The causes are either found in the mother, as circulatory disturbances—for instance, in torsio uteri—or in the calf. Putrefaction can only occur where air enters so that the bacteria of putrefaction may exert their influence. No putrefaction takes place when the foetal membranes are intact, as the bacteria cannot penetrate them (Franck).

When the foetus dies and the waters are partially discharged, the foetus may remain in the uterus on account of the encumbered expulsion, and decomposes. Expulsion may be

interfered with by a malposition of the calf, insufficient dilatation of the cervix uteri, or by a foetus absolutely or relatively too large.

After the calf dies and air enters freely, putrefaction soon sets in, as the development of putrefactive bacteria is favored by the body temperature. The foetus becomes an incubator of low organisms.

As a result of the putrefactive gases, blisters form all over the skin. Here and there blisters from dollar to fist size form, become confluent and distend the skin over a large area. In the intermuscular tissues blisters also form. The blood decomposes most rapidly. Since the tissues are saturated with plasma, stained with the coloring matter of the red blood cells, the muscles and glandular organs show a dirty red color. The liver, being full of blood, quickly decomposes. It has a mottled and pasty appearance. The latter is caused by the blisters formed underneath the serosa. In consequence of the decomposition and chemical changes of the constituents of the tissues, sulphuretted hydrogen, various carbonated hydrogen gases, ammonium and butyric acid forms. The sweet and fetid air coming from such a foetus is especially noticeable on exploration.

*Symptoms.*—The death of the foetus is characterized by phenomena occasionally overlooked by the owner. The symptoms indicating birth of the emphysematous foetus are sufficiently plain to be appreciated by him.

Putrefaction of the foetus toward the end of pregnancy—that is, at a time when natural birth should occur—is of great importance to obstetrics, as parturition is impossible on account of the excessive dimensions of the calf. When we are called to treat such cases, the owner often imagines indigestion present rather than approaching birth. The cow eats but little, defæcation is hard and retarded, rumination has ceased and some tympanitis is noticeable. Examination reveals that the cow is in a state where birth may take place. There is complete, or partial, depression of the broad ligaments, the udder is filled, the left as well as the right side of the belly is dis-

tended, especially in the lower abdominal region. The general state of health is more or less depressed, although such animals may be apparently well,—even cover considerable distances. The temperature is  $39.5^{\circ}$  to  $40.5^{\circ}$  C.

When the examination confines itself only to inspection, the true course of the symptoms may be overlooked, especially as the pains are very feeble in such cases, and are only observed with difficulty on account of the great distention of the uterus. The failure to make a vaginal exploration would lead to unfortunate consequences in such a case. In some animals the attendant observes the discharge of the foetal waters, or dejection of a fetid, chocolate-colored liquid from the vulva; or the secundinæ may partly hang from the vulva. Such symptoms soon help us to recognize this condition.

Exploration throws still more light upon the case. The hand introduced into the vagina immediately feels the increased heat in the parturient passage. Sometimes, as the result of insufficient preparation for birth, the cervix uteri is but little dilated; the os uteri *may* be sufficiently dilated, but in most cases no complete dilatation occurs, since the mechanical dilatation by the water bag did not take place; nevertheless, the hand can, as a rule, be passed into the uterus.

The distended calf, tightly enveloped by its membranes, is felt in front of the uterus. The uterus, mostly contracted, is moulded upon the calf when the greater portion of the foetal waters has escaped. By stroking the calf with the hand a distinct crackling is observed as the gases accumulated beneath the skin are displaced by the pressure of the hand. The calf feels like dough. It is rounded in shape, the hairs are easily pulled out, the claws sometimes can be stripped off, unless they are already lying in the uterine cavity. When putrefaction is far advanced the bones of the head separate at the sutures, and the epiphyses and diaphyses of the long bones can be drawn apart. The whole gives off an unbearable stench, adhering for days to the clothing. A dirty brownish, fetid liquid escapes from the vulva during and after the examination. In multiple gestation, it happens occasionally that

one calf is born alive while the other is emphysematous (Albrecht).

As a rule, decomposition sets in eighteen to thirty-six hours after death of the foetus; but, before it becomes completely emphysematous and enormously distended, before the hairs fall out and claws drop off, forty-eight hours or more may pass.

*Course and Prognosis.*—Unless professional aid is rendered, the termination is fatal. The cow dies within a few days with septicæmia, unless the course of the trouble is hastened by rupture of the uterus and septic peritonitis. Even with proper treatment, a guarded prognosis must be given, as we cannot predict the effects of toxins already taken into the circulation. Besides, a septic metritis following retention of the afterbirth may terminate fatally. The prognosis in general should be "doubtful."

#### THE OPERATOR'S PROPHYLAXIS.

When delivering an emphysematous foetus, it is essential to consider even very small wounds of the hands and arms. Especially abrasions and wounds about the finger-nails are often overlooked and serve as an entrance to infection. Small wounds and abrasions should be covered with iodoform-collodium or collodium elasticum, or painted with tincture of iodine; the iodine remains as a protective antiseptic cover after evaporation of the alcohol. While at work, a pail with a 2 per cent. creolin solution should be kept at hand, to wash hands and arms now and then. The oiling of the arms and hands with creolin oil (1 part creolin to 20 parts of oil) must be done with great care. The obstetrician must never neglect this preparatory treatment. Experience teaches that by delivering such cases local infections occur, which endanger the life of the surgeon unless attended to.

*Treatment.*—When possible, total extraction should be attempted. Although the changes render the calf very pliable, extraction rarely succeeds, as the parts usually separate wherever they are corded. We start by oiling the genital

passage and by injecting large quantities of warm water into the uterus to prevent suction. The cervix uteri, when not fully opened, is mechanically dilated by the hand. Extraction may now be practiced.

The head and fore legs, when occupying the vagina, are secured, the former by hooking the orbital cavity or by looping the neck, the latter by cords above the fetlocks. It is not advisable to loop the inferior maxilla of the calf, as it is easily torn off. In the posterior presentation, both hind legs are guided into the pelvic canal and corded above the fetlocks.

The force of two men is employed for extraction. Unless putrefaction is too great, and the calf of ordinary size, extraction may succeed. Many veterinarians make numerous incisions into the skin of the calf with a sliding bistoury, to diminish the volume of the calf. The result is not satisfactory. In most cases nothing is of any use, the hooks tear out or the shin-bones break, when strong traction is exerted.

But we must not allow things to reach that point, as the sharp bones of the leg and the broken upper jaw would injure the uterus or vagina. When decomposition is well advanced, the strength of one man suffices to sever the leg at the point the cords are fastened. Such cases where everything tears which is fixed, are especially discouraging to the beginner, but here again patience will bring about a happy termination. Where extraction is impossible, embryotomy must be performed. We must remember at the same time that it is impossible to do a regular embryotomy; for instance, when we begin with one fore leg and skin it, its removal as a whole is not to be expected, as it frequently separates at the carpus or elbow-joint. In such a case the different bones of that fore leg are to be removed individually before the other fore leg is operated upon. The amputation is readily accomplished. The reduction of emphysematous calves is difficult and tedious work, requiring a great deal of patience. By means of embryotomy it becomes possible, although requiring often a good deal of time. The results are best when the operation is done subcutaneously and not too much traction practiced, it greatly

lessening the danger of an injury. Very small wounds of the parturient passages may form the focus of a fatal infection.

The after-treatment in such animals is of the greatest importance. Whenever possible, the placenta must be removed immediately after parturition, since its decomposition forms an excellent medium for pathogenic micro-organisms. Insufficient contraction of the uterus prevents their manual removal, as all the cotyledons cannot be reached by the hand. In either case antiseptic uterine irrigations must be employed. For that purpose a 1 to 2 per cent. creolin, lysol or alum solution is indicated.

After removal of the afterbirth, the uterus is thoroughly irrigated with cold water. I have frequently succeeded in lowering the body temperature in one hour one degree by irrigating the uterus with cold water. This is followed by an irrigation with creolin solution, which is allowed to run out of the uterus. Should it be impossible to remove the afterbirth by hand, the uterus is to be irrigated twice daily with a 1 per cent. warm creolin solution. After a few days the uterus contracts sufficiently so that the cotyledons can be reached and the afterbirth removed. Now the irrigations are continued once daily until the os uteri closes to the extent that the hand cannot be passed any longer and the discharges of the uterine secretion have become very limited. Internally, antiseptics are given, camphor with oleum terebinthinia (camphoræ, 5.0; olei terebinthinæ, 15.0; pulv. rad. althææ, 40.0; fiat pulvis, dentur tales doses iv.; S. twice daily one powder). The administration of borax in large quantities (100 g. per day) can be recommended.

After such a prolonged case of dystokia, leaving the cow more or less soporous, coffee with æther may be given.

The cords used in this parturition are to be burned to prevent their infecting an animal at another occasion. The iron instruments are to be heated. Simply rinsing them in the creolin or carbolic acid solutions is insufficient; the many depressions on the filed surface make a thorough disinfection by rinsing them an illusory one.

### 3.—Dropsy of the Fœtus.

Dropsy of the brain, *hydrocephalus*, as well as dropsy of the skin, *anasarca*, and dropsy of the abdominal cavity, *ascites*, form obstacles to parturition.

#### (A) HYDROCEPHALUS.

A great deal of fluid is found in the cranial cavity, causing atrophy of the brain, distention and atrophy of the cranial bones (fig. 19).



Fig. 19.—Hydrocephalus.

*Symptoms.*—When the hydrocephalus enters the pelvic inlet, resting on the fore legs, the claws of the fore feet extend as far as the vulva and no further. As a rule, the calf does not

rotate completely; after partial discharge of the foetal waters and while the fore legs pass into the pelvic canal, the hydrocephalus lies laterally or sinks down between the anterior limbs. On exploration, the strongly distended head is not always recognized immediately as such, as it fluctuates on pressure. A careful examination soon explains matters.

*Treatment.*—Whenever possible, the head should be placed upon the fore legs. For this purpose the calf is pushed back into the uterus, the inferior maxilla is grasped with the hand, or corded and drawn.

After the normal presentation has been established, the head is fixed as mentioned above, and a *long, deep incision* is made with the sliding bistoury along the suture of the cranial bones (Fontanelle). It is impossible to split the head without fixing it, as it recedes from the pressure of the knife. After the incision, a serous fluid is evacuated, while in many cases the dimensions of the skull remain the same. The fragile plate of bone underlying a thin skin can be crushed by the hand. With the head in the vagina, the cranial bones can be readily caved in by placing the hand between the head and upper vaginal wall and pulling on the fore legs. Some advise to remove the head with the chain saw, after it is firmly fixed, so that decapitation occurs in the region of the atlas. Should it be impossible to extract the foetus as a whole after incising and crashing the cranial bones (cephalotripsy), the subcutaneous removal of one or both fore legs is the easiest method. After that the hydrocephalus can be drawn into the parturient passage.

Deneubourg passes a long hook into the mouth and attempts to destroy the floor of the cranial cavity. From here strong traction on the hook shall destroy the base of the cranium and evacuate the fluid.

Hydrocephalus is mostly seen in the anterior presentation. In the posterior presentation (Lassartesse) the condition is frequently only recognized after partial embryotomy. Deneubourg describes a case, where twin calves with hydrocephalus and both in the posterior presentation were born.

## (B) ANASARCA AND ASCITES.

Anasarca in the calf occurs in connection with ascites and hydrothorax. Calves of this kind are designated "lard calves" (*Speckkälber*) or "moon calves" (*Mondkälber*). On account of dropsy, the foetuses are of enormous dimensions, and in an ordinary presentation are twice as wide as a normal calf. It is rounded in shape, the trunk forms a short cylinder, from which in front the head and laterally four short legs project as a result of the oedematous state of the subcutaneous and intermuscular connective tissue. Such hydroptic calves are usually born at the seventh or eighth month of pregnancy. As a rule, they are hairless, the hide resembling chamois-skin.

*Ætiology.*—It is decidedly doubtful whether hydropsy of the foetus follows dropsy of the mother and co-exists with it; on the contrary, this oedematous condition depends on diseases of the foetus. Franck mentions the post-mortem of a dropsical calf, where hydropsy was produced by the absence of the ductus thoracicus and larger lymph vessels. Schurink (Holland) found in a dropsical calf, born seven weeks before the end of pregnancy, kidneys weighing together 4.25 kg. Arloing (St. Cyr and Violet) mentions a similar case, where the kidneys weighed 2300, respectively 1990 g. The liver weighed 2.6 kg. Cystic degeneration of the kidneys was present. Nocard described a very exact autopsy of a calf with ascites. The liver weighed 2.5 kg. The left ventricle of the heart showed chronic valvular endocarditis.

In some instances dropsy of the foetal membranes is present at the same time. Hermenier observed a case of dropsy of the kidneys giving rise to dystokia. The kidneys were four times as large as the head of a man and contained 15 l. of fluid. Hermenier offers as cause for this dropsical change the absence of the urachus.

*Diagnosis.*—It is not very difficult to recognize such a so-called "lardaceous" calf. In the anterior presentation the small fore legs have hardly entered the pelvis. Exploration reveals the doughy, fluctuating surface of the calf, the rotundity

and enormous size of the trunk. The impression is conveyed as if the whole calf is a large elastic ball. In the posterior presentation, with the hind legs in the pelvic canal, the claws reach only as far as the vulva. Exploration reveals the rounded buttocks and the fluctuation of the body.

*Treatment.*—The total extraction of such a calf rarely succeeds; as a rule, embryotomy must be performed. But we may first attempt to reduce the size, by many long and deep incisions into the cyst of the skin along the shoulders and back, evacuating the amber-colored liquid contained within those cysts. Should this be successful, extraction may then be attempted. Since the trunk of the calf is very elastic, strong traction—for instance, four men—may be exerted without danger. When extraction is out of the question, the fore legs are amputated and evisceration performed. Parturition, as a rule, then takes place when traction is practiced on the head and the two flaps of skin of the removed fore legs. Complete embryotomy is performed when necessary. Adler-Rottenbuch recommends to open the cysts in the skin; next, to secure the head with a thin rope and to draw it outside the vulva. The head is amputated and the cord is placed around the calf behind the fore legs. Now a long incision is made into the abdominal cavity, and the act of parturition is brought to an end by slow traction of six to eight men.

When the "lard calf" lies in a posterior presentation, first one hind leg and one half of the pelvis of the same side and then the intestines are removed. In order to get rid of the fluid, long, deep incisions are made along the back. By pulling on the remaining hind legs the whole calf can be extracted. It is advisable to fasten the cords in such calves as close to the trunk as possible. For instance, on the fore legs the loops are placed above the carpi, and on the hind legs above the hocks.

Ascites in the calf may be so extensive that parturition cannot take place without aid. Occasionally calves with ascites are aborted, but they may be hairy and carried to the end of the term. Hydropsy may confine itself to the thorax and abdominal cavity; anasarca may be entirely wanting.

*Diagnosis.*—When a calf with ascites is born in the anterior presentation, parturition is interrupted as soon as the anterior half of the body has been born; the distended abdominal wall lies in front of the pelvic inlet. The attendant, who already pulled on the thin fore legs and small head, is astonished that he cannot extract the calf, and thinks of an abnormal development of the posterior portion of the body. Manual examination detects the exceedingly soft distention and fluctuation behind the last ribs of the calf.

In the posterior presentation, with the hind legs in the pelvic canal, the posterior limbs do not pass any further beyond the vulva than half the length of the metatarsal bones. In this position exploration and diagnosis are much easier.

*Course.*—When the owner pulls very hard, after the anterior extremities of the body are born, it may happen that suddenly a loud report manifests itself, terrifying those engaged in traction, followed by easy extraction of the calf. Those present wonder at the amount of force required to extract such a small calf. Soon after the calf is born a great deal of fluid is discharged from the uterus. The cause of this phenomenon, as well as the course of parturition, is easily explained. The extraordinary tension resulting from traction ruptured the abdominal wall. In bull calves with ascites the abdominal liquid may be pressed into the scrotum, distending the latter to an extent that interferes with birth. Severe traction may rupture the scrotum, and the liquid is evacuated.

In most cases the attendant's resources are exhausted and he sends for the veterinarian.

*Treatment.*—In those cases where one half of the calf is born, one fore leg and five to six ribs of the same side are removed. After removal of the thoracic viscera the diaphragm is punctured by hand and the fluid in the abdominal cavity is allowed to flow off. When necessary, the contents of the abdominal cavity are removed, and parturition is finished by simple extraction.

A. Hörner suggests to pass the probang when the anterior half of the calf is born, to remove the water of the abdominal

cavity. A few strong blows suffice to perforate the rumen, traction is exerted upon the fore legs and the water flows out. In this manner he met with good results in three cases without performing embryotomy.

In the posterior presentation, with the hind legs in the parturient passage, one hind leg and the pelvic half of the same side is removed; after evisceration the calf is extracted by the other hind limb. Should abnormal presentation be present, reposition is first practiced, followed by the above described procedure.

#### 4.—Monstrosities.

Vice in conformation of the foetus does not necessarily form an obstacle to parturition. Many monstrosities are born without aid. Only those shall be mentioned of importance to obstetrical practice.

*Classification.*—Monstrosities may be divided into two main groups, viz.: simple and compound monstrosities. To the former, among others, belong the *acardiacus*, the "otter calf," divisions of the head and trunk, *peromelus* and *perosomus columbus*.

Enumerated among the compound monstrosities are the *diprosopus*, *dicephalus*, *ischioptagus*, *pygopagus*, *dipygus*, *prosopothoracopagus*, *synkephalus*, *craniopagus*, *thoracopagus* (sternopagus and xyphopagus), and *polymelus*.

The "otter calf," or calf with congenital rhachitis (fig. 20), has very short limbs. The diaphyses are short, the epiphyses very wide and thick. Palatoschisis, hydrocephalus and brachygnathus is often present.

The excessive bicostal and bitemporal diameter of such calves may render parturition difficult. Nevertheless, after oiling the passages well, extraction is mostly successful, by pulling on the legs or leg, by hooking the inner canthus of the eye. Should this fail, embryotomy is indicated.

*Clefts of the Head and Trunk.*—Here belong, among others, the *cranioschisis* and *rachischisis*, as well as the *ectopia vis-*

cerum. To the latter: *schistosoma, fissura abdominis*, or real abdominal cleft, from navel backward including pubis.

The *schistosoma reflexum* is a monstrosity quite frequently observed in the cow (fig. 21). Franck mentions 39 cases; St. Cyr saw 11 out of 49 monstrosities; Rieck, 49 out of 197 monstrosities. The teratological museum of the veterinary school at Utrecht has 13 skeletons, also some parts of calves curved backward. Franck compares the latter monstrosity very properly with an acrobat whose body is bent forward until the hands touch the ground, so that the superior and inferior limbs come together.

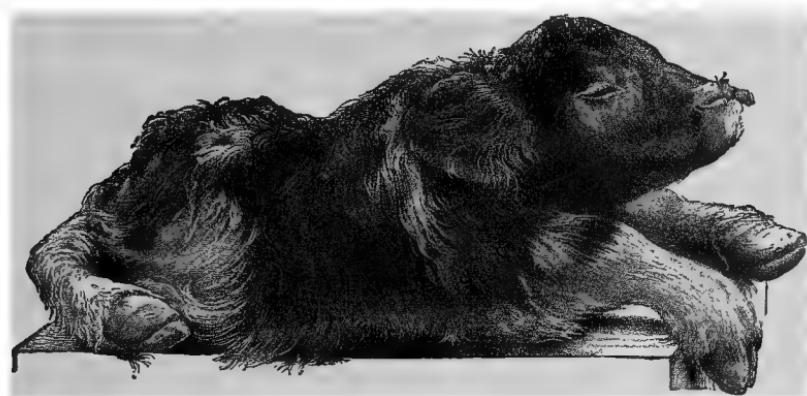


Fig. 20.—The "otter calf."

The spinal column has a double S-curve, so that the postero external angle of the ischicum lies in the region of the fifth cervical vertebra. The ribs, usually bent upwards, are crowded and frequently grown together, forming, so to speak, a plate in which the few fissures point to former ribs. The intestines are exposed.

*Symptoms at Parturition.*—In many cases the attendant first notices the protrusion of intestines at a time when the legs enter the parturient passage. Sometimes pretty strong pains are present and the intestines of the calf do not enter the vulva. On exploration, a broad mass surrounded by intestines

is felt. Continuing palpation, one or more legs, the curved spine and occasionally the head is recognized.

*Prognosis.*—On the whole, it is favorable. Experience teaches that the schistosoma is quite elastic, and consequently can mostly be extracted in spite of the abnormal position.



Fig. 21.—Schistosoma Reflexum.

*Treatment.*—Many obstetricians first tear the intestines loose by hand and remove them. Others allow an assistant to fix the intestines outside the vulva, attempting to secure the hind legs by means of cord and loop. There is no definite method for the extraction of this monstrosity. A good deal depends on whether part of the body is accessible or not.

When it is possible to recognize the curved spinal column and cord it, it is advisable to fasten the chain saw to this rope and to pull it far enough to run through the vertebral column. After dividing the monstrosity in this manner, extraction may take place.



Fig. 22.—*Perosomus Elumbus*.

Extraction is often successful when a hook can be securely fastened in the pelvis. Whenever necessary, the fore and hind legs may be removed, followed by extraction of the foetus.

J. van Klaveren (Holland) reports three cases where he successfully delivered the schistosoma. He did not sever the

intestines, but removed the presenting limbs. Extraction could then always be accomplished by the two remaining legs.

*Perosomus elumbus* (fig. 22) may give rise to dystokia. In this monster the lumbar vertebrae are wanting. It is completely covered with skin, only the spinal column is not continuous. Röder also describes such a case.

Of the compound monstrosities, I mention the *diprosopus* (fig. 23), the face of which is more or less double. On examination, one may at first imagine to deal with twins. But when the head is pushed back the other follows the movements and the skull common to both, and the actual state of affairs is recognized.

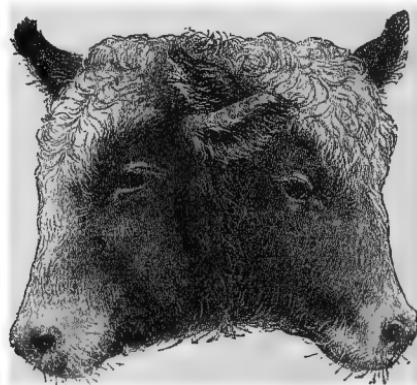


Fig. 23.—Diprosopus.

*Treatment.*—A hook is fastened into the internal canthus of one eye, and attempts are made to bring the double head in an oblique direction through the pelvic canal. As a rule the fore legs, which also occupy the parturient passage, interfere with this operation. After removing them subcutaneously the head is mostly able to pass. Should it still be unable to glide through the pelvic canal, the chain saw easily and quickly cuts through the skull.

The *dicephalus* (fig. 24) may be treated in the same manner as the diprosopus. In case the division extends far backward, partial embryotomy may be resorted to.

*The pygopagus.*—Dr. Vaerst, at Meiningen, described an

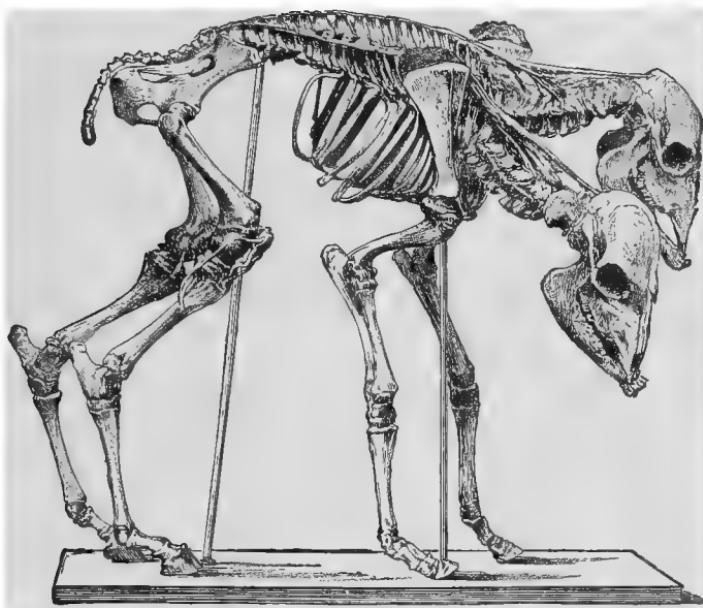


Fig. 24.—Dicephalus.

interesting case. After the first calf was almost completely

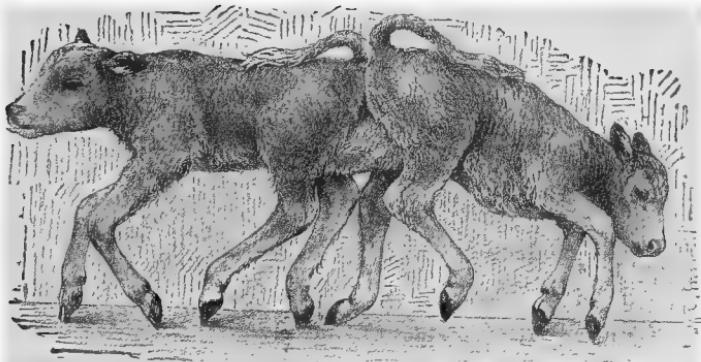


Fig. 25.—Pigodidymus Aversus (Vaerst).

born, it could not be extracted. By exerting traction with six

to eight persons the second calf followed, grown to the hind-part of the first one (fig. 25). The calves, fully developed, possessed a common umbilicus and were  $1\frac{1}{2}$  m. long. The umbilicus is visible in the drawing between the hind legs. Gurlt designates this monstrosity as *pigodidymus aversus*.

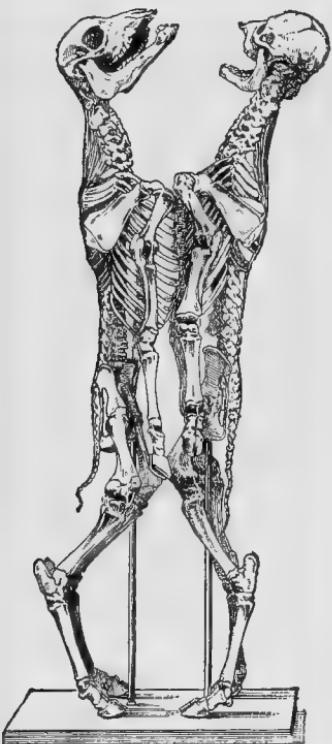


Fig. 26.—Thoracopagus.

already entered the pelvic canal should be repelled in order to assure a thorough examination and allow us to make plans for extraction, respectively embryotomy.

*Treatment.*—Total extraction can only be attempted in small fetuses, or when parturition takes place in the seventh or eighth month; while embryotomy must be resorted to in voluminous monstrosities. No special directions can be given.

Vaerst truly says: "For the obstetrician such a monstrosity is a hard nut to crack." When the first calf protrudes from the vulva as far as its hind extremities, nothing can be done but to pull until the second calf also is extracted. Should it be possible to detect this abnormality within the uterus, division in some way or other may possibly be accomplished.

The *thoracopagus* (fig. 26) is a monstrosity consisting of two foetuses grown together at the xyphoid cartilage of the sternum and its neighborhood (*xyphopagus*), or having a common thoracic cavity (*sternopagus*).

It is often very difficult to diagnose it. In the beginning one always thinks to be dealing with twins. A close examination only can ensure a diagnosis. Any parts which have

In the *xyphopagus*, reduction with the chain saw might be tried; in the *sternopagus*, an attempt to remove a head, neck and fore legs is indicated. When this is followed by traction on the remaining head and fore limbs, extraction as far as the hind parts might succeed and further division or embryotomy finish it.

*Polymelus*.—Although this monstrosity does not, as a rule, cause dystokia, the supernumerary limbs might interfere with expulsion. With regard to the differential diagnosis, twins alone can be considered. Embryotomy in these cases is mostly crowned with success.

*Synkephalus* and *dipygus* may give cause to difficulties in a posterior presentation.

## OBSTETRICAL OPERATIONS.

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Obstetrical operations are of great importance. The practical application of the data contained in the previous chapters and the operative aid rendered in most cases by the obstetrician shall be discussed here.

A thorough knowledge of topographical anatomy is in this instance just as essential as in operative surgery, among which the operations on the mother animal may be classed. Knowledge of the mechanism of parturition may form a valuable guide in the *modus operandi*.

The operations on the foetus are either of a bloodless or bloody nature. To the former belong the diagnosis and repossession of abnormal presentations; to the latter, partial and complete embryotomy.

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### I.

#### OPERATIONS ON THE PARENT.

##### 1.—Vaginal Hysterotomy.

*Definition.*—By hysterotomia vaginalis is understood the forcible dilatation of the cervix uteri, by incisions into superior and lateral walls of the canal, which do not extend beyond the circular muscular layer.

*Topographical Anatomy.*—The cervix uteri constitutes the most posterior portion of the uterus, and represents the connection between the body of the uterus (corpus uteri) and the vagina. In the vagina it appears as a round, free body, having a diameter of 4 cm., exhibiting many folds, and is termed the vaginal portion (portio vaginalis) of the uterus. The cervix is composed of three layers. The internal layer, a mucous mem-

brane, possesses many transverse folds, which secrete a viscid, opalescent slime during pregnancy, sealing hermetically the canal of the cervix uteri.

The submucosa is rich in elastic and fibrous fibres, its lower portion having many veins and some arteries.

The muscularis, lying between the mucosa and serosa, is made up of concentric fibres, forming, so to speak, a sphincter muscle, and therefore designated *sphincter cervicis*. The outer muscular layer consists of longitudinal fibres, which are lost in the vagina. The external face shows a serosa, the peritoneum, which to some extent covers the vagina, reduplicates and lines the rectum. The excavation thus formed represents the so-called *excavatio rectovaginalis*.

During dilatation of the cervix the canal is partly opened by the uterine contractions, gradually involving the cervix, partly by the mechanical action of the water-bag. This dilatation is so considerable on account of the many elastic fibres and numerous folds of the *palma plicata*, that the *corpus uteri* and *vagina* form one wide canal for the passage of the *foetus*.

*Indications.*—When the above described dilatation does not occur, the birth of the *foetus* stops. Many causes may produce insufficient dilatation. We have seen already that in many instances dilatation can be effected with the fingers or with the hand. It was also pointed out that many conditions may be mistaken for spasm of the cervix or obliteration of the cervical canal. Obliteration of the cervical canal is the only indication for *hysterotomia vaginalis*. It may be the result of a cartilaginous-like degeneration, from cicatricial tissue or adhesions between the walls of the cervical canal following injuries. In those cases conception took place at a time when the canal was still open and the wound not yet completely healed. The injury was received at a previous birth.

Should the diagnosis be doubtful, mechanical dilatation must first be attempted. Forceful dilatations must remain the last resort.

*Details of the Operation.*—Balestra already in 1816 performed vaginal hysterotomy in the cow after the Richerand

method. Binz also mentions it in his obstetrical work, 1830, page 136. In cases where cartilaginous-like degeneration or extensive cicatricial tissue close the cervix uteri, an unfavorable prognosis must be given. I am of the opinion that the good results of many operators are partly due to the fact, that in those cases where operative interference was practiced, just as good results would have been obtained by a bloodless mechanical dilatation. The operation is performed as follows: The vagina is prepared by rinsing it with a 2 per cent. creolin solution; the hind legs of the cow are tied to prevent kicking the operator. It is preferable to operate the cow standing. Some prefer the recumbent position, as the os uteri is pushed further back and the operation is actually performed in the vagina; nevertheless, the standing posture is best.

The bloody operation is executed by introducing a probe-pointed bistoury with the cutting edge upward as far as possible into the cervical canal. By pulling it backward and forward, the upper wall is incised. This is accompanied by a crackling sound. The incision penetrates the circular layer and is sufficiently deep when all resistance is overcome. Besides the upper incision, two lateral ones obliquely upward are made.

It is not necessary to make more than three incisions. The parts are next explored to see whether the incisions extend sufficiently; when necessary, they are made longer. Should, as a result of violent pains, the os uteri protrude at the vulva, the sliding bistoury may be used. A very good instrument is also the adjustable herniotome. The hemorrhage during and after the operation is trifling.

Further dilatation is effected by boring movements of the hand and fingers. Now patience becomes a virtue, and mechanical dilatation is left to the water-bag. It is faulty to draw head and fore legs into the pelvic canal and exert traction immediately after the operation, as it may result in ruptures by which the abdominal cavity is opened. It is much better to wait for some time after the operation to apply but limited traction.

*Sequelæ.*—A favorable termination may be anticipated when dilatation after the operation is completed by the water-bag and foetus. When during parturition much traction had to be employed and the parts torn, a favorable issue is still possible provided the serosa is intact and no communication with the abdominal cavity exists. It sometimes happens, in parturitions with incomplete dilatation, where head and legs nevertheless enter the pelvic canal, that the portio vaginalis tears to pieces, when traction is exerted, without causing death. Lacerations situated anteriorly are much more dangerous, as the circular muscular layer is much thinner in that region. It frequently happens that, following the operation, dilatation is insufficient, and that deep lacerations extending into the abdominal cavities result from traction. Unfavorable termination of the operation is due to septic peritonitis or a post-partum infection. The latter frequently occurs and can only be obviated by careful after-treatment, which should always be practiced in such animals. It consists in the early removal of the secundines, slight cauterization of the wounds and antiseptic irrigations. For cauterization, a 5 to 10 per cent. solution of zinc chloride or lunar caustic is used; tincture of iodine may also be used. As an antiseptic, and at the same time astringent irrigation, a 2 per cent. alum solution renders excellent service.

## 2.—Artificial Abortion.—*Partus Præmaturus Artificialis.*

In some cases it may be indicated to produce birth at a time when the foetus is not yet completely developed. Artificial abortion in the cow is not often practiced, and its sequels are often of a serious nature.

*Indications.*—The diseased states indicating artificial abortion are :

1. *Dropsy of the Fætal Envelopes.*—The time at which the operation should be performed for this condition depends on the intensity of the disease and general state of the parent; as a rule, the seventh or eighth month of pregnancy is selected.

2. *Certain pelvic fractures* acquired during gestation and producing pelvic constriction on account of callus formation. In those cases where stenosis only decreases the pelvic dimensions about one-third, embryotomy is preferable to artificial abortion. The same refers to pregnancy in the very young female.

3. *Metrorrhagia*, which is the result of placental hemorrhage during pregnancy. Violent uterine hemorrhages in the cow usually are caused by rupture of large blood vessels, so that our only means consists in artificial abortion and subsequent contraction of the uterus; but in most cases artificial parturition is too slow to save life.

4. *Great weakness of the mother* toward the end of pregnancy in the seventh or eighth month, in consequence of which death of the parent and calf may be safely concluded should termination of gestation be waited for. In such a case the calf is sacrificed to save the cow.

5. *Osteomalacia*.—This treatment has occasionally yielded good results.

6. *Prolapsus vaginalis and dislocatio uteri*.—Prolapsus vaginalis in the second half of pregnancy may take such dimensions, and with the animal lying down the os uteri protrudes beyond the vulva, and rupture of the uterus must be expected from the severe throes. This danger can usually be obviated by raising the hindquarters, by daily exercise and nutritious food and by administering agents quieting abdominal pressure. In serious cases, and in the last month of pregnancy, parturition may be produced artificially (St. Cyr and Violet).

*Procedure*.—Many methods applied in human obstetrics are useless in the cow. The procedure consisting in mechanical dilatation of the cervical canal by boring movements with the oiled finger, gives no results, even when frequently repeated. In the eighth month this method may give good results.

One of the best means is the puncture of the foetal envelopes and partial evacuation of the foetal waters; but it has the disadvantage that the calf is born dead. As a rule, this is

of no importance. The puncture is made with Charlier's trocar through the cervix or right flank. When operating through the cervical canal, the finger is pushed forward as much as possible, the canula is introduced and the membranes punctured with the trocar. A thin catheter may also be used in the same manner to puncture the envelopes. The foetal waters flow off through the vagina. (Puncture through the right flank is only practiced in hydrallantois).

Usually twelve to fourteen hours pass between evacuation of the foetal waters and manifestation of pains (Harms). Dolmer described a case where the cow only calved after eight days; 100 l. of liquid were discharged by puncturing the flank.

The injection of warm water between the uterine mucosa and the chorion may be attempted to produce contractions of the uterus.

The mechanical dilatation of the cervical canal by a prepared sponge is to be omitted, for fear of an infection.

Pelzer recommends the injection of 150 g. of glycerine into the uterus to produce pains. This method has occasionally caused symptoms of intoxication in human obstetrics.

The action of certain medicaments known as ecbolics, and administered with a view to produce abortion, is unreliable. We know that secale cornutum assists uterine contractions when already present, but does not produce them primarily. The same refers to sabina. But abortion may occur when toxic doses are given. Thomassen effected partus præmaturus in a cow with hernia uteri by injecting subcutaneously 0.1 g. ergotin.

*Sequelæ.*—When artificial abortion is finished, the placenta must be expelled. In most cases the union between the maternal and foetal placenta is quite firm and the uterine contractions weak. The conditions in the cow are unfavorable with regard to separation of the placenta; physiological expulsion is already much slower than in other domestic animals.

Unless precautions are taken the secundines decompose, endangering the life of the animal so that artificial abortion is

in vain and may even terminate in death of the parent. Rational treatment is required to prevent this.

On the whole, the result of the operation is not very favorable in bovine practice, and is therefore rarely performed; but in hydrallantois good results are obtained provided proper after-treatment is practiced. *The latter, therefore, is of great importance.*

### 3.—Laparotomy.

*Definition.*—Laparotomy is an operation in which the abdominal cavity is opened by incising the flank. In obstetrics it is usually performed as a part or first step of other operations.

*Indications.*—Laparotomy is indicated in torsio uteri after all other attempts to correct the abnormal position have failed. It may also be indicated in extra-uterine gravidity to remove the foetus, although this occurs rarely in obstetrical practice. It constitutes the first step of the Cæsarean section (*sectio cæsarea*). At times it is performed to explore the cavity, when we suspect peritoneal abscesses as the result of a perimetritis. The cow being exposed to very little danger, justifies laparotomy as a diagnostic operation.

*Procedure.*—It is preferable to operate in the standing posture. In this way the danger of a possible eventration is much less; palpation also is much easier. The field of operation is the right flank or the right lower abdominal region. That location depends to a great extent on the purpose laparotomy has in view. Thus, in torsio uteri, an incision made too high is extremely uncomfortable to the obstetrician who has to rotate the uterus, although there is less danger of an eventration. Detorsion of the uterus is much easier when we operate in the right lower abdominal region, but the chances for complications are greater. To avoid these difficulties the lower portion of the right flank should be selected as the field of operation. The same spot may be chosen to perform the Cæsarean section. *The explorative operation is made on the right upper flank.*

*Preparation.*—When the cow is operated standing, she is pushed with the left side against some wall or partition and kept there by four assistants. In front of the right hind leg a long pole is driven obliquely into the ground, so that the lower portion of it is right under the right half of the udder, while the free end is pushed against the cow by an assistant to prevent her from stepping sideways and interfering with the operator.

The hair is shaved from the external angle of the ilium to the last rib, and from the transverse processes of the lumbar vertebrae as far as the region of the stifle. Now this part is brushed with soap and warm water and rinsed with a 2 per cent. solution of carbolic acid. All this is done by an assistant, and not the operator.

The operator in between times washes the hands and cleans them mechanically, especially the finger-nails. It is much better to scrub them for a while with warm water and soap, than to dip them simply into an antiseptic bath.

The necessary instruments, boiled before the operation, are: one bistoury, a pair of forceps, two artery forceps, a probe-pointed bistoury, a pair of scissors, aseptic silk, needles, an Heister needle and thread to suture the skin. Some towels which have been lying in a 2 per cent. carbolic acid solution must also be on hand.

With the convex bistoury the operator incises the skin of the right flank in the direction of the fibres of the internal oblique muscles to an extent of 15 cm. The length of the wound in the Cæsarean operation is 40 cm. The incision begins 4 inches from the external angle of the ilium and is made of sufficient length forward and downward with one stroke. The second cut severs the fibres of the external oblique muscles in the direction of the skin wound and crosses the fibres of the last named muscle. Now the internal oblique muscle is cut in the direction of its fibres, remembering that it grows thicker as we go up, and that the hemorrhage may be quite severe when branches of the circumflex iliac artery are cut. Finally, the transverse abdominal muscle and transverse fascia are severed,

leaving the abdominal cavity only closed by the peritoneum. A fold of the peritoneum is picked up with a forceps and incised; further division is performed with the fingers. It is not advisable to perforate the peritoneum, as in this way it may be separated to quite some extent from the fascia transversa.

In the operation on the standing cow no intestines enter the wound, but do so occasionally in the recumbent position. In such a case it is kept back with a towel by an assistant. Hemorrhage is controlled by torsion.

After the operation, which was to succeed laparotomy as reposition of the uterus, metrotomy or the diagnostic exploration has been performed, the abdominal wall is sutured.

*Suture.*—It is not necessary to suture the peritoneum or fascia transversa, but the abdominal muscles are to be firmly united. This is done with pretty strong silk by the continuous suture, bringing the stitches quite close together, puncturing each side about seven to eight times. (See Bayer's Surgery, page 100).

[Since the work is not accessible to the majority of English speaking veterinarians, any of the modern surgical works, as Möller's, may be consulted.—W.]

The beginning and end of the thread is secured, the knot is drawn into the lower corner of the wound and the thread cut off closely. The skin is stitched with the interrupted suture. For this purpose strong twine is used. About eight sutures are required. To secure firm union, Heister's needle is used and introduced quite a distance from the edges of the wound.

The neighborhood of the edge of the wound is now dressed with *ung. cantharidum 1:3*, carefully avoiding any soiling of the wound proper. Swelling, which soon follows, closes the wound and assists healing by first intention. When asepsis is practiced, healing soon occurs. An abdominal bandage in such an animal is not only unnecessary, but useless. It is impossible to secure it, and its dislocation may interfere with the healing process.

To prevent the wound from becoming covered with dust, or otherwise soiled, it may be covered with sublimat-glycerine-gelatine, an excellent agent, surpassing in this instance collodium or traumaticin.

[Sublimat-glycerine-gelatine is prepared by taking a definite amount of ordinary sheet gelatine. This is soaked in water containing 1 per cent. corrosive sublimate. After thoroughly soaking it, the mass is gently heated and 10 per cent. of glycerine is added. When needed, it is heated and applied in a thin layer with a brush.—W.]

When the operation is performed aseptically, no further treatment is necessary. Although the silk is slowly resorbed, it does not produce suppuration. After about six days the wound forms a nice granulating streak, showing the silk here and there. This becomes imbedded and the wound is healed completely in fourteen days; at that time union is so firm that the stitches may be removed from the skin.

To prevent pressure against the wound by the intestines as much as possible, the cow's hindquarters are elevated.

#### 4.—Cæsarean Section, *Gastro-hysterotomy*.

Gastro-hysterotomy is an operation known for centuries, birth taking place by means of laparotomy and metrotomy. It is an operation endangering the life of the mother, although danger is to-day materially lessened on account of our knowledge of infectious agents and means to prevent them.

*Indications.*—Cæsarean section is not frequently performed in the cow. It is only indicated where the calf cannot be born naturally in spite of all attempts. When the foetus is accessible to the hand, other methods are usually employed to deliver it; for instance, embryotomy, an operation much less dangerous when rationally performed. Only in obliteration of the cervical canal, where vaginal hysterotomy has failed, and in torsio uteri, which could not be reduced even by a laparotomy, may it be indicated (Albert). This operation is not

justified when the parturient passages are normal and the foetus absolutely too large.

In most cases the owner prefers to slaughter the animal, especially when other manipulations have been practiced. The chance for a successful issue is still more limited when hysterotomia vaginalis or laparotomy have been performed, and in the latter manual detorsion of the uterus has been attempted.

Nevertheless, the Cæsarean section can be executed, and when artfully performed may be crowned with success, should the owner be anxious to save a valuable animal. This is proven by numerous communications in veterinary literature.

*Procedure.*—The standing posture of the animal is best adapted for the operation. In many cases this is impossible, and we must operate the cow in the recumbent position. She is placed upon the left side and the posterior extremities are raised.

Before operating, the fore and hind legs are tied separately and poles are driven into the ground, one in front of the hock joint, the other behind the carpus, protecting the surgeon and enabling him to operate on the abdominal wall. Four assistants, one to the head, one at the tail, and two at the back, hold the cow in place.

The hair is shaved over an area much greater than the incision, the skin is scrubbed with soap and warm water, and finally with a 2 per cent. carbolic acid solution.  $\text{\textcircumflex}$ Ether or chloroform may be given should a sufficient number of assistants be present. The field of operation lies in the right lower abdominal region; in other words, where the calf can be plainly felt. The higher the operation is performed the less the danger of a future eventration, but it is much more difficult to withdraw the uterus and its contents.

We only operate in the linea alba when the parent is to be slaughtered and the calf only is to be saved. Should we wish to keep the mother alive, this operation is not justifiable, for various reasons. The incision through the udder, the pressure of the intestines upon the stitches in the abdominal walls, the

limited powers of regeneration of the elastic fibrous tissue, are important factors.

The cut through the skin is made from above and behind to before and below, in the direction of an imaginary line drawn from the external angle of the ilium to right fore claw. Some (Albert) make a perpendicular incision through the right lower flank. The length of the incision is about 40 cm. The abdominal wall is split in the same way as in laparotomy (see page 215). Now the most important part of the operation—metrotomy—begins.

First the hand acquaints itself in the abdominal cavity with the position of the calf. As a rule, its hindquarters lie close to the wound, it being the most favorable position for extraction. That part of the gravid horn turned toward the diaphragm is drawn with the hind extremity of the calf into the wound, or if possible outside the belly, upon an aseptic cloth resting against the edge of the wound. This manipulation is difficult, but it is much better to proceed in this way than to incise the uterus in case it remains in situ.

The horn, which has been pulled outside the wound, presses upon the edges of the wound, so that any hemorrhage is immediately stopped and the complete occlusion prevents entrance of air and eventration.

Metrotomy is performed outside the abdominal cavity to stop the foetal waters or uterine secretions from running into the peritoneal sac. The uterus is incised in the long direction of the gravid cornu. The dimension of the cut cannot be given with certainty, since it depends on the size of the foetus. It must be sufficiently large to allow the calf to pass without tearing the edges of the wound.

As a rule, the incision extends beyond the mucosa into the chorion; as a result of this the allantoic fluid is discharged. The chorion is now torn by hand and the calf quickly extracted.

The edges of the uterine wound must be fixed by assistants in order to prevent retraction of the incised womb by the uterine contractions and soiling of the peritoneum. Of course it is understood that the assistants have clean hands and

towels and have been previously instructed. The secundines are detached from the placenta $\mathfrak{e}$  matern $\mathfrak{e}$  and removed. The uterus, which has contracted still more during this time, is wiped clean with a towel, thus removing the uterine milk and remains of the foetal waters. All this and the suturing is done external to the abdominal cavity.

*Uterine Suture.*—This must be made with the greatest care to prevent the uterine secretion from passing through the wound into the abdominal cavity.

The contraction of the uterus favors the closing of the wound, reducing it about one-half in a few hours after the operation. Cat gut is used as suture, practicing Lembert's method. In order to strengthen the suture, the wound is first thoroughly stitched, bringing the edges into close opposition. Then Lembert's suture through serosa and muscularis is put in, inverting at the same time the first stitches. In this manner firm union is assured. Now the sutures are dried and the uterus replaced.

The abdominal wound is closed in the same manner as in laparotomy.

*After-treatment.*—When a Cæsarean section is artfully performed, no further treatment is necessary; only certain complications are to be avoided. For the first few days the food must not be voluminous.

The upper portion of the wound usually heals more kindly than the lower one. Occasionally necrotic tissue is found in the wound after five to six days. It is to be removed and the wound treated on general surgical principles.

*Course of Operation.*—Should healing by first intention take place, union of the uterine wound occurs in eight to ten days. The portion projecting into the lumen of the uterus undergoes fatty degeneration; later it disappears entirely. The localized peritonitis about the uterine wound assists in the union of the serous membranes and does not lead to adhesions.

The involution of the uterus takes place rapidly, the uterus obtaining its normal form in due time. No rise of tem-

perature follows the operation when healing proceeds as just described. In some cases peritonitis follows the operation, either as a result of soiling by the uterine secretions or foetal waters, and through infection during the operation by the operator or his assistants. Peritonitis is very liable to set in when eversion of the intestines occurs. At the same time it is not necessarily fatal, although a doubtful prognosis should be made. Peritonitis may produce extensive exudation and later adhesions, leading to a subacute or even chronic course.

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## II.

### REPOSITIONS AND OPERATIONS ON THE FŒTUS.

#### 1.—Diagnosis and Correction of Malpositions.

*Definition.*—Abnormal position.

In the normal presentation the anterior extremities—that is, the head resting upon the fore legs, or both hind legs—lie in the parturient passage. In both of these positions the belly of the calf is opposite to the abdomen of the cow. Such a presentation is known as the *abdominal position*.

Any position deviating from the above is abnormal. While interfering frequently with birth, it need not necessarily become a cause of dystokia. The possibility exists that the calf may be born without assistance in spite of an abnormal position when the cow's pelvis is wide and the fœtus small.

#### THE ART OF REPOSITION.

The art of reposition deals with the abnormal positions and indicates their correction. Therefore we shall discuss successively: the measures to be taken by the obstetrician for his own or the cow's sake, the diagnosis of abnormal presentations, and the rules applicable to each case.

A precaution exercised by the obstetrician consists in the proper choice of clothing while at work. A veterinarian must not be afraid to soil his clothing, and should not wear expen-

sive clothing when practicing obstetrics. Many suggest the mere removal of the coat and tucking up of the sleeves. This is impractical and insufficient, as the underwear bulges at the upper arm, thus interfering with the introduction of the arm and exploration. At the same time it is apt to slip and become wet. It is best to wear a flannel shirt and another one without sleeves; further, an ordinary vest, when necessary, over it, a sleeveless blouse, and a pair of old breeches. Some use knee pads, consisting of leather, with buckle and strap. They are fastened about the knee in the same manner as knee pads on the horse. These knee pads are very nice, preventing the knees from getting wet, especially for veterinarians who are called on to do obstetrical work while attending to their regular route.

The dangers to which the obstetrician is exposed are either direct or indirect ones, as kicking or falling of the animal, or infections.

It is rarely necessary to secure the cow; an assistant holds the tail and pays attention that the arm of the veterinarian is not soiled by faeces. Should it be necessary to put the cow on her back, the fore and hind legs are fastened separately and held by assistants.

When an exploration is made on the standing cow, we must keep an eye on her constantly, to prevent fracture of the arm as she suddenly drops.

The infection which frequently threatens the obstetrician consists of a pustulous exanthema of the arms and hands. Some people are especially susceptible to it. It is often seen after delivering a decomposing foetus, a so-called emphysematous calf, although the obstetrician may become infected by dead and not yet decomposing foetus (Plessow). Experience teaches that no immunization occurs after recovery from the infection, but that it increases susceptibility.

*Symptoms.*—About ten to sixteen hours after delivering the calf, the arm and hand begin to itch, usually first below the ulna. On close examination many little spots of pin-head size are observed, especially where the hair is. The itching

sensation increases, the red spot reaching a diameter of  $\frac{1}{2}$  to 2 cm. on the second and third days; frequently the axillary glands swell. During the first two days the red spots increase in number. The first spots feel more or less hard, the redness being diffused. On the third day the color changes in the centre and a little vesicle with serous contents develops, to become purulent on the fourth day, seen by the white ring in the central red elevation. During this time itching has been pronounced, so that the patient must force himself not to disturb the normal course by rubbing.

On the fifth day the epidermis contracts hyperæmia and itching diminishes.

On the sixth day slight exfoliation takes place, the process coming to an end in a few more days.

Many deviations from the course are observed. Plesson states that the primary red points increase in size and extent up to the sixth day. Chills and insomnia set in, new abscesses forming constantly, not only in the region of the old ones, but also in new places. This existed for three months, when recovery took place.

As a rule, the infection is of a local character, does not disturb general health, and terminates in a few days.

*Prophylaxis.*—The infection seems to occur in numerous places through abrasions. Embryotomy favors it, especially as the epidermis is injured here and there, allowing entrance of infectious material. Each pustule represents a local infection. By simply washing with cold water, low organisms with their media (foetal waters, soft parts of the calf, placenta) remain behind in invisible quantity on the parts denuded of epidermis.

These organisms are readily concealed on hairy parts, and can only be removed by a thorough cleaning (Hohmann). The prophylaxis consists in covering any small wound with iodoform-collodium before the operation. Arms and hands are dressed with 5 per cent. carbolized oil, to be cleansed mechanically after parturition is effected. The latter is best done by scrubbing them with soap and warm water (Klaeber), fol-

lowed by a wash of bichloride of mercury solution 1-1000, or a 2 per cent. creolin solution.

Veterinarians not dressed for the occasion frequently soil the sleeves with blood and foetal waters. After disinfecting hands and arms the dirty sleeve is pulled down, thus offering an excellent opportunity for infection. Under such circumstances the underwear must be changed and the arms and hands disinfected again on their arrival at home.

When infection has once taken place, it is advisable to apply bandages saturated with a 1 per cent. corrosive sublimate solution to the arms and to keep them wet with the solution. Of course, it is understood that a physician is consulted. Infection may also occur after delivery, as the following instance shows:

In November, 1892, I was requested by the butcher J at Z to deliver a double-ender in a two-year-old heifer. The foetus was absolutely too large and the pelvis constricted laterally. Complete embryotomy was performed. The various parts of the calf weighed altogether 60 kg. On my arrival the calf was still alive, but was sacrificed to save the cow.

After completing the work, the owner brought a bucket of water to wash in. Two assistants and myself cleaned our arms and hands with soap and this water. A third assistant, who could not wait, washed himself at a neighbor's. The following day a pustulous exanthema, as described, developed on myself and those two assistants who washed themselves with the water out of the bucket. The third assistant, who assisted mainly in embryotomy, was not attacked.

In all probability infection occurred while washing ourselves. It was discovered later that the bucket which served as a wash basin was used to collect intestines not yet cleaned. This water was full of low pathogenic organisms, causing the local infection. The pustulous exanthema disappeared in about six days. The cow was not the least disturbed from this difficult parturition.

*Care of the Animal.*—The owner of an animal requests veterinary service to save an animal. He has confidence in

our knowledge, and can demand that all means known to science be applied. The obstetrician, therefore, is in duty bound to omit nothing which may hasten or bring about a favorable termination.

The first point to be observed is sufficient room and light. When no room exists we must do the best we can, but when present, there is no excuse for working in a limited space between other animals. The cow is taken to another place, or, should this be impossible, the adjoining cows are to be removed. While the owner may not like such changes at first, he will soon see that the treatment in this way is assisted and made easier.

The attention of the beginner must be drawn to the fact that practical actions and plodding in the dirt are not alike, but that he is practical who uses the means within his reach properly and artfully. Since most births occur in the evening or at night, care should be taken to provide sufficient light. It is foolish to say that light is a secondary consideration, since parturition takes place in the dark anyway. The obstetrician must see the whole animal and prevent, if necessary, an eventual tympanitis, by straightening the cow and overlooking his assistants.

Straw or hay, etc., must be handy in sufficient quantities to make a soft bedding. Elevation of the hindquarters of the cow assists greatly in the work. The obstetrician may carry infection from one cow to the other. This is done by hands and arms insufficiently cleansed, or shirt sleeves soiled at a previous case, but also by ropes and instruments. The obstetrician may also infect a cow when previously engaged in the removal of an emphysematous foetus and decomposing secundines, without taking the necessary precautions.

*Diagnosis of the Abnormal Position.*—A correct diagnosis is half the reposition. When this is duly considered, matters are less difficult than they appear to be. While it often requires great pains to recognize the position of the calf, no doubt in regard to it should exist. When matters are left to chance, disappointments are apt to follow. Only after a thorough

diagnosis has been made, can we form plans for reposition, which may then be executed with confidence. Without a firm diagnosis the obstetrician is at a loss, and loses the necessary self-confidence.

The general rules of the art of reposition must be applied in each case. By it the correction of an abnormal presentation is simplified; their omission may render reposition impossible. The first condition to remedy a malposition is room for manipulations. It can only be obtained in the uterus when not contracted. When head or legs in abnormal position have passed the pelvic inlet, they must be repelled.

Should the uterus mould itself on the calf, as it occurs when the foetal waters have been discharged, it must be replaced by introducing warm water into the uterus. The warm water, which should be of the temperature of the body (Franck recommended it already in 1876), or a 1 per cent. creolin solution, is introduced by means of rubber tubing and a funnel. J. G. Eberhard, as early as 1793, suggested slimy decoctions for this purpose.

The correction of a faulty position is greatly assisted by the liquid, as the uterus is less contracted and, therefore, interferes less with the operation.

Many obstetricians are in the habit of fixing temporarily all parts of the body which lie in the pelvic canal, by means of a cord, in order to draw them later into the parturient passage when necessary. It will be of advantage to the beginner to practice this method, while the experienced man need not necessarily follow it.

In certain cases, especially when portions of the calf have been driven into the pelvic canal by strong pains, it is advisable to practice reposition on the standing cow. This affords more room and often assists in defining the existing conditions. Should reposition be practiced in the recumbent position, it is best to place the animal upon its *right side*, or in a straight position upon the knees. In this way tympanitis, setting in at times during parturition, can be obviated. Sometimes it is indicated to place the cow upon the *left side* or in a dorsal

position in order to reach the head or flexed legs. An animal may be placed into any position should it further the purpose; but the cow cannot endure the dorsal position very long, and contusions of the sacro-iliac articulation may follow strong traction in this position.

To correct an abnormal position the hand is principally used, and the use of instruments should be deferred as long as possible. In most instances reposition by hand is possible, and the parts in the parturient passage can be secured after reposition. With practice, decided dexterity is acquired, and disagreeable complications are less liable to follow birth. Cords are often necessary; hooks, porte-cords, etc., can be often dispensed with.



Figs. 27 and 27a.

*Instruments Used in Repositions.*—Of the many obstetrical instruments, to which new ones are constantly added, only a small number are of use. Although the discussion shall touch upon many useless instruments, a description of the various mechanical means is indicated.

One of the most useful agents is hemp-rope, usually 2 m. long and 7 mm. in diameter. A loop is on the one end, the other one being wrapped with string to prevent its unraveling. Thin cords hold better, but soon cut the parts. Thin cords, of course, may be doubled and a doubled noose be made (figs. 27 and 27a).

Many obstetricians prefer for the head and legs a web 3 cm. wide and 2 m. long, or a band. They have the advantage of being more pliable; do not slip and cut.

*Parts of the Body which are Corded.*—When the fore or hind legs lie in the pelvic canal they are usually corded above the fetlocks, especially when strong traction must be exerted. No foetal membranes should be caught between the rope and the parts corded. When the head is to be fixed the loop is placed around the lower jaw, or the rope without a noose is run around the whole head behind the ears. In the latter instance the middle of the rope is pushed over the skull behind the ears by means of the tips of the fingers. Now the two free ends beneath the lower jaw are twisted until the rope no longer slips off when pulled at. This cord is more readily applied than the head stall constructed by Binz, Schaack and Rueff. A loop is only then placed around the upper jaw when it is desirable to pull the head backward in the direction of the skull, otherwise the loop slips off. In the normal presenta-



Fig. 28.—Binz's Repeller.

tion, extraction may be practiced by placing the cords above the carpi or hocks. In those stables where but little room is found behind the cows, so that the assistants soon touch the wall with their backs, such ropes are of service.

In order to exert force, round sticks, 30 cm. long and of a diameter of 4 cm. in the middle and 3 cm. on their ends, are fastened to the ropes. The free end of the cord is placed around the middle of the stick with a surgical loop. The conical shape of this stick renders the removal of the rope easy.

To repel the calf comfortably, Binz constructed a wooden instrument, which he terms goblet-repeller (Stossbecher) (fig. 28). It is used when the head is already in the vagina and the fore legs still in the uterus. The goblet is placed over the nose of the calf, the crutch against the breast or shoulder of the operator.

Although the instrument can be used occasionally to advantage, it is better to replace it by the hand. Retropulsion of the calf is aided materially by placing the hindquarters of the cow into an elevated position, or, if possible, inducing the cow to stand up. When the feet are braced well, the hand, resting upon the forehead or nose of the calf, can exert just as much force as the goblet-repeller. Günther had an instrument



Fig. 29.—Repeller.

made for the same purpose, termed by him "obstetrical crutch." It consists of an iron cylinder 75 cm. long, having on the one end a concave cross-piece and a handle on the other. It is used by placing it against the cervical portion of the sternum and the calf repelled; while doing so the hand must always accompany the instrument. The calf may also be repelled by Günther's crutch when in the posterior presentation; that is, the buttock toward the pelvic inlet; in such a case it is placed against the postero-external angles of the ischium.



Fig. 30.—Träger's Wire Loop.

An instrument of similar construction is that crutch especially used for retropulsion in the posterior presentation (fig. 29). The rod of this instrument has a concave transverse piece with a spike; the latter is introduced into the arms.

Träger had a wire loop made of brass, mainly to fix the head when flexed backward. The above cut (fig. 30) gives an idea of the instrument. In order to secure displaced parts, which cannot be reached with the cord, so-called porte-cords have been constructed. Günther's porte-cord (fig. 31) consists of two iron rods placed upon each other, 78 cm. long. The upper one is provided with a handle and ring, so that the

lower one can be pushed to and fro. Two jaws, the lower one of which is movable, and which can be closed by pushing the rod ahead, are found on the one end. The noose is now placed between the jaws of the instrument and introduced. It proved itself useless in practice. Already in 1793 Eberhard



Fig. 31.—Gunther's Porte-cord.

had made for the same purpose a turning stick (Kehrstock). This instrument consists of a whale-bone with a knob of ivory on the one end; a vertical groove in the knob receives the rope or web.

Binz's obstetrical probe (fig. 32) is a flat, curved stick, 45 cm. in length, with an eye in the curved end. It is mainly used to cord the head when deviating backward, or the legs



Fig. 32.—Obstetrical Sound.

when incompletely extended. The rope or noose is run through the eye, and carried behind and around the retained part, until the loop can be grasped with the hand and the instrument retracted.

Günther's long hook (fig. 33) is used in the same way as the porte-cord.



Fig. 33.—Gunther's Curved Porte-cord.

Darreau's porte-cord (figs. 34 and 34a) is 80 to 85 cm. long, the rod having a diameter of 6 to 7 mm.

Binz, Schaack, Rueff constructed porte-cords to secure the head, which can be dispensed with in practice.

To correct deviations, hooks may be used. In the living calf blunt ones only are used in case of necessity. Should the foetus be dead, sharp hooks may be employed.

In the dead calf hooks are especially used to secure the displaced head, by inverting them into the internal canthus of the eye. Such hooks may also be fastened in the inferior maxilla and ligamentum nuchæ. When placed into the



Figs. 34 and 34a.—Darreau's Porte-cord.

ear, septum nasi or skin hooks usually tear out. In the posterior presentation in a dead calf they may be passed through the rectum into the oval foramen or in front of the symphysis. Blunt hooks are preferable. There are two kinds of hooks, short and long ones. The former are 12 cm. long, with an eye 3 cm. in diameter at the one end; the width at the curved portion is 3 cm. A rope with a loop is run through the eye, which is used for traction (fig. 35).

The curved portion of the hook is covered with the index finger when introducing it.



Fig. 35.



Fig. 36.

Obstetrical Hooks.



Fig. 37.

The long hook has a length of 60 cm., and on the end a handle or crutch.

In order to fix the head a double hook may be used. It consists of two separate hooks inserted into the orbital cavities. A rope is passed through the rings of each hook to retain them in place and to permit of traction.

Vogel constructed an iron, nickel-plated double hook on the principle of Reimer's hook, being 12 cm. long, and its seg-

ment 5.4 cm. wide. These hooks, closing in the same way as a forceps, do not injure the uterine walls. It is Vogel's opinion that they can be used to draw forward limbs retained in the uterus, to extract a fully developed dead foetus, to remove inaccessible parts after embryotomy, etc.

The plain hook of Vogel is provided with a hinge and spring in the curved portion of the hook, so that the point of the hook can be held in the hand (fig. 36).

A very useful instrument is Obermayer's hook, its segment having a width of 4.5 cm. (fig. 37).



Fig. 38.—Kaiser's Double Borer.

Kaiser constructed a double auger to adjust misdirected parts of a dead foetus (fig. 38). The double end, shaped like a corkscrew, is bored into the skin or parts below and can be retracted into the canula.

## 2.—Classification of Abnormal Presentations.

The longitudinal presentation was previously termed a normal presentation, and represents a position in which the long axis of the foetus runs parallel with the long axis of the mother. It must be at the same time an abdominal position—that is, the abdomen of the calf lies opposite to the belly of the mother. In this position the head, resting upon the fore legs, as well as the hind legs, may enter the parturient passage. We look upon both as normal. In either case the conditions for the passage of the foetus are very favorable, and parturition usually takes place without assistance. Any deviation from that position interferes with expulsion, as the dimensions of the calf do not correspond with those of the pelvis of the cow.

The obstetrician then attempts to correct the presentation, in order to aid the passage of the calf through the pelvic canal.

## RESTORATION OF THE NORMAL PRESENTATION.

In the following I give a synopsis of the abnormal presentations.

Usually two main groups are recognized: the longitudinal and transverse presentations. The vertical presentation was already discussed under anteversion.

### I. LONGITUDINAL PRESENTATION.

#### 1. *Abdominal position.*

##### (a) *Abnormal position of one fore leg.*

Fore leg with the flexed carpus against the symphysis.  
" " " " in the pelvic canal.

Fore leg bent back under the body, the shoulder against the symphysis.

Fore leg bent back under the body, the shoulder in the pelvic canal.

##### (b) *Abnormal position of both fore legs.*

Both fore limbs as under a.

##### (c) *Abnormal position of the head.*

The head resting against the shoulder.

" " " " thorax.

" " descended between the fore legs.

" " deviated upward and backward.

##### (d) *Abnormal position of head and fore legs.*

##### (e) *Abnormal position of one hind leg.*

One hind leg flexed, fetlock under or against symphysis.

One hind leg flexed, fetlock in the pelvic canal.

One hind leg entirely retained.

##### (f) *Abnormal position of both hind legs.*

Both hind legs as under e.

#### 2. *Costal Position.*—The thoracic wall of the calf is turned toward the abdomen of the cow, the fore or hind limbs with eventual deviations lie in front or in the pelvic inlet.

3. *Dorsal Position.*—The back of the calf is turned toward the belly of the mother, the anterior or posterior extremities occupy the parturient passage, offering some of the above deviations.

## II. TRANSVERSE PRESENTATION.

The abdomen or back of the calf in this presentation lies toward the pelvic inlet. For this reason an abdominal transverse presentation and a dorsal transverse presentation are recognized.

In the former the abdomen is opposite to the inlet; in the latter the back of the calf presents itself transversely in front of the pelvic inlet.

In the abdominal transverse presentation, one or more legs may enter the pelvic canal, sometimes all four legs; should the head also enter, the hindquarters descend on account of its weight, and the transverse presentation changes into the longitudinal presentation, in consequence of which the hind limbs and anterior extremities lie in the so-called dog-sitting position (Harms).

## I.—LONGITUDINAL PRESENTATION.

### 1.—ABDOMINAL POSITION.

#### (a) ABNORMAL POSITION OF ONE FORE LEG.

*The fore legs with the flexed carpus against the symphysis.*

*Causes.*—Insufficient dilatation of the cervix uteri and early rupture of the water-bag. Traction by the attendant while exploring on the normally presented fore leg before complete rotation of the calf took place.

*Diagnosis.*—On exploration the normally presented fore leg and head are recognized in the pelvic canal; the bent knee lies opposite the pelvic inlet or below it. By gliding downward along the flexed limb, the fetlock and claws are felt. When

the greater part of the foetal waters is discharged, the uterus is firmly contracted upon the calf.

*Prognosis.*—Favorable.

*Treatment.*—Passing the hand into the uterus, the opened hand is placed against the skull, thumb and fingers to either side, and the calf is pushed back. If possible, the cow is standing, the calf then slips back itself. To adjust the retained leg the hand grasps the shin-bone and pushes the bent knee upward. Now the hand glides downward, takes hold of the claws and draws the limb into the pelvic canal (fig. 39).



Fig. 39.—Abnormal Position of One Fore Leg.

Should this method fail, a loop is placed below the fetlock. Now, while repelling the calf by hand, the leg is pulled gently into the parturient passage. In those cases where the fetlock of the retained leg can be corded, reposition by hand is usually possible.

*The fore leg bent at the carpus and in the pelvic canal.*

(Pelvic knee presentation, Harms.)

*Causes.*—The causes are the same as those in the last presentation. As a rule, the expelling powers have been here more successful, as the foetus was small or the pelvis more

roomy. This presentation often succeeds the last named one, when the owner has exerted severe traction on one fore limb or head.

*Diagnosis.*—The fore leg lying in a normal position has been drawn as far as the vulva or into it. The head rests in the pelvic canal. The other leg, doubled up, is felt on the side of the pelvic passage; the radius is directed backward while the metacarpal bone rests upon the floor of the pelvis. The leg is wedged tightly, so that it is often difficult, at times impossible, to reach the claw of the flexed leg.

*Prognosis.*—On the whole, it is favorable, but there is danger of injuring the floor of the vagina.

*Treatment.*—*The calf must be repelled.* Should the foetal waters have been entirely evacuated, infusions of warm water may be employed. Following retropulsion, reposition may be attempted. Occasionally the carpus has advanced so far, that it is closer to the pelvic outlet than inlet. It does not occur with laterally constricted, respectively juvenile, pelvis. Here retropulsion is more risky, on account of rupturing the roof of the vagina, than extraction. In such a case a thin loop is placed around the inferior extremity of the radius, and the calf is extracted in the direction of the sacrum. Severe traction must not be exerted, and only two men are allowed to pull.

Should the foetus be dead, the chain saw is placed around the knee and the joint cut through. The lower portion of the leg is then removed with the hand. A thin rope is next placed around the lower extremity of the radius, and traction practiced. The sawed part is covered by the hand during extraction to protect the vaginal wall against injury. In case no chain saw is handy, a thin, tough iron wire will replace it, used exactly as the saw to cut the skin and joint.

*The fore leg bent back under the body, the shoulder against the symphysis.*

(Unilateral shoulder presentation, Harms.)

*Causes.*—This abnormal position arises when the head enters the pelvic inlet before rotation of the calf takes place.

Also during incomplete dilatation, when the owner pulls on that fore leg which is in a normal position, while the other lies with the carpus against the symphysis.

*Diagnosis.*—Head and fore leg lie in the pelvic canal, but have more advanced than in the carpal presentation. By gliding the hand along the head and neck, the scapular spine, below it the elbow joint, and the radius extending backwards, is detected. As a rule, the claws of the retained limb can be reached.

*Prognosis.*—Favorable.

*Treatment.*—Small calves, such as twins, can be extracted in this abnormal presentation; but the diagnosis must be positive before it is attempted. Large calves are not to be extracted, nor is birth possible with a constricted pelvis.

Extraction is performed by pulling on the head and the fore leg in the pelvic canal at the same time. Nevertheless, it is better to adjust the malposition. This is quite easily done in small and living calves. The manipulations to correct the faulty state are as follows: The hand grasps the shin-bone with the thumb resting on the anterior face of the bone, the carpus is flexed toward the symphysis; while the carpus is pushed upward the calf is repelled, the hand glides downward, seizes the claws and draws the leg into the pelvic canal.

Should this method fail, the fetlock may be corded. By repelling the calf with one hand the leg is slowly carried into the parturient passage. When the calves are very voluminous, in double-enders, emphysematous calves, the uterus may contract to such an extent that neither retropulsion nor reposition are possible.

Under such circumstances infusions with warm water, followed by reposition, are tried. Should this also fail, we resort to embryotomy, removing subcutaneously the fore leg lying in the pelvic canal. After this reposition of the retained leg is usually possible. When necessary, partial embryotomy can be continued, removing the head, neck and even the retained limb at the shoulder.

*The fore leg bent back under the abdomen, the shoulder in the pelvic canal.*

In this instance parturition has further advanced, be it on account of stronger uterine contractions or because the owner pulled on the presenting parts.

*Diagnosis.*—The head and one fore leg are well forward in the pelvic canal, one-half of the metacarpal bone of the anterior limb lying normally projects from the vulva, the nose is visible between the labiæ. On exploring the side where the leg is bent backward, the shoulder is felt in the pelvic inlet. The parts resting in the vagina are often wedged.

*Prognosis.*—Favorable.

*Treatment.*—When the calf is small and the pelvic canal normal, as is usually the case in cows which have calved repeatedly, extraction is possible in this abnormal position. Traction is then exerted on the head and the fore leg presenting itself normally. Should the calf be alive, reposition is attempted by retropulsion, thus changing this presentation into the preceding one. But when severe traction has been practiced by the owner, wedging and killing the calf, when the uterus has finally contracted so that repulsion appears impossible, embryotomy must be performed. In these cases partial embryotomy is mostly sufficient and more advisable than forcible extraction.

#### (b) ABNORMAL POSITION OF BOTH FORE LEGS.

The treatment is the same as given under reposition of one fore limb. One must not omit to immediately cord the adjusted leg, before correcting other abnormalities.

Special discussion is required in case *both fore legs are bent backward under the abdomen.*

The causes are insufficient dilatations of the cervix uteri, feeble pains and thus slow rotation of the calf. This abnormal presentation is often met with in partus prematurus at the seventh month.

*Diagnosis.*—The head has progressed as far as or beyond the vulva, its ears being visible between the labiæ. On explora-

tion, gliding along the neck, both shoulder blades are found within the pelvic inlet, the fore legs are bent backwards. The examination is often very difficult, the fore legs frequently being beyond reach.

For the sake of a correct diagnosis and treatment, it is of great importance to know whether one or both carpi have entered the pelvic canal.

The *prognosis* is favorable with small foetuses, also with large ones provided the owner did not attempt to extract the calf by the head. When the head has been forcibly drawn beyond the vulva, it is advisable to give a doubtful prognosis.

*Treatment.*—It is possible to extract calves in this presentation in the seventh or eighth months of pregnancy, provided the cervix uteri is sufficiently dilated. The head is fixed with a rope behind the ears by placing the noose between the branches of the lower jaw, so as to prevent tightening. Should the calf be dead, a blunt hook, with a rope, is inserted into each internal canthus of the eye. The calf is brought into a costal position, so that the bicostal diameter of the calf lies parallel to the greatest diameter—the height—of the pelvic inlet. Now one or two men can extract the calf.

We proceed in the same way with calves of normal size and with a wide pelvis, as found in cows four and five years old. It does not succeed in primiparæ, especially when only two years of age.

When called in time to such cows and the foetal waters have not yet been discharged, it is possible to repel the calf and attempt reposition. Reposition is to be practiced by slow and persistent pressure, and not by jerks, while the cow is standing, or by raising the hindquarters. Should retropulsion be impossible and the calf already dead, embryotomy is called for. The head is skinned outside the vulva, the neck is removed subcutaneously, the muscles severed around the shoulder; a rope is fastened about the scapula, the fore leg drawn from the skin and removed. The other fore leg is now adjusted and the calf extracted. When extraction is still impossible, embryotomy is to be continued.

## (c) ABNORMAL POSITIONS OF THE HEAD.

Malpositions of the head are frequently seen in obstetrical practice.

*Causes.*—One of the main causes is found in the persistence of the intrauterine position on account of insufficient uterine contractions. Incomplete dilatation of the cervix uteri may cause the head to turn over in spite of sufficient rotation of the calf, when the anterior limbs have already entered into the vagina. Again, it is frequently produced when the owner pulls on the fore legs while the calf is still in the costal presentation. There are people who immediately roll up the sleeves after the water-bag has ruptured, pass the hand into the vagina and fix the fore legs. Complete rotation has not yet taken place at that time. The calf is still partially in the costal presentation, in consequence of which the head easily turns over when traction is exerted upon the fore legs.

*The head resting against the shoulder.*

*Diagnosis.*—Both fore legs rest in the pelvic canal, but one has progressed a little further than the other one. On exploration, the side of the neck is felt by gliding over the anterior face of the legs, palpating laterally, the ears, and further on the eyes and nose are detected.

This abnormal position is often seen in cows with a pendulous abdomen.

*Treatment.*—Reposition is easy when the calf lives; first, because the uterus has not firmly contracted; and secondly, because living calves change the position of the body by their movements, thus assisting an adjustment. After both fore legs have been fixed by cordoning them above the fetlocks, the lower jaw is grasped with the hand by placing the thumb into the mouth and the index finger below the jaw. By pulling toward the operator the head is brought upon the fore legs, and traction is exerted on them. After the head is once in the pelvic canal, it is held there by the hand to keep the mouth upon the metacarpal bones.

Should it be impossible to bring the head into the pelvic canal with the hand, a loop is placed around the lower jaw and traction practiced. At the same time the obstetrician repels the calf by placing the hand against the sternum. With regard to the fixing of the rope, attention should be paid that the hand which cords the head stays on its side and does not glide across the neck to the inferior maxilla. In the latter case the neck would be twisted by pulling and reposition becomes impossible. When the head rests against the right shoulder, the cow is placed upon the right side, and upon the left side should the head be turned against that side; this renders reposition easiest.

When the calf is dead the head may be fixed by placing the thumb and index finger into the orbital cavities, or a hook may be used instead. It is advisable to use the hook only in case of necessity. Only when reposition by hand fails, and the eye, but not the mouth can be reached, is the application of the hook indicated.

In all cases where the foetal waters are completely discharged and the uterus firmly contracted and the head cannot be brought into the parturient passage, embryotomy is called for. Both fore legs are removed subcutaneously; this gives ample room to draw the head into the pelvic canal and fix it.

*The head resting against the thorax.*

This abnormal presentation may follow the preceding one when traction is exerted on the fore legs while the head is turned against the shoulder (fig. 40).

*Diagnosis.*—The internal examination, as in the preceding portion, reveals the side of the neck in front of the pelvic inlet, while the skin of the neck is more tense. The fore legs are further advanced into the vagina.

*Treatment.*—The method is the same as in the presentation just discussed, but special attention must be paid that traction, after cording the lower jaw, is practiced in the right direction, to prevent twisting of the neck. On the whole, reposition is here no more difficult than in the preceding position.

In calves which are very large and dead, and where we know in advance that total extraction is out of the question, especially in a juvenile pelvis, it is better to remove one or both fore legs subcutaneously than to draw the head forcibly into the pelvic canal.

*The head descended between the fore legs.*

The depression may be limited, so that the ears lie opposite the anterior border of the pubis, but the upper border of the neck may be directed against the symphysis.

*Diagnosis.*—The fore legs in this malposition have not passed as far into the pelvic canal as in other faulty head posi-



Fig. 40.—Lateral Deviation of Head, resting on thoracic wall.

tions. On exploration, the vertex of the head or upper border of the neck is felt between the fore limbs, and a little upward the withers. By gliding downward on the anterior pubic border the dorsal portion of the nose can be reached (fig. 41).

Severe traction on the legs greatly interferes with palpation. In such a case it is advisable to repel the calf and examine anew. By placing the cow in a dorsal position the head can be readily reached.

*The prognosis is favorable when the calf is alive and the foetal waters are not yet entirely evacuated; but is doubtful*

when the uterus has firmly contracted, as it may lead to rupture.

*Treatment.*—Wherever reposition by hand is possible, it should first be done. The cow's hindquarters are raised or she is made to get up; in consequence of this the calf descends. The hand is pushed between the fore legs and downward into the mouth of the calf, the thumb is placed on top of the nose and three fingers into the mouth. By drawing the arm toward the operator, one often succeeds in raising the head and placing it upon the fore legs; this manipulation is greatly

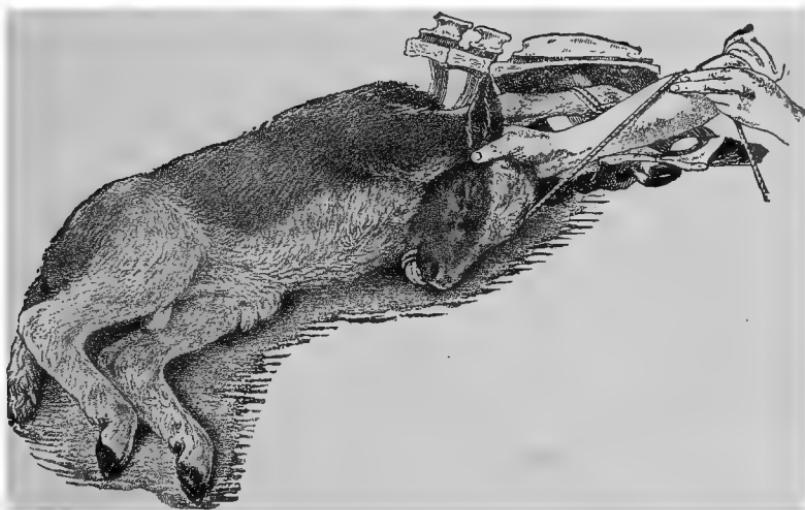


Fig. 41.—Downward Deviation of Head, between fore legs.

assisted when an assistant repels the calf by the fore legs. Should this method fail, a noose is placed around the lower jaw, pulling on it with one hand, while the other repels the calf. The hand which effects this may seize the inferior maxilla as soon as it is raised some, and draw it into the parturient passage.

When all these attempts are without success, the cow is put on her back, at the same time raising the hindquarters. Now the head is more accessible. After repelling the calf, the

head may be brought upon the fore legs either with the hand or by cording the lower jaw. Should a small, blunt hook, to which a rope is attached, be inserted into the orbital cavity, it should be covered by the hand to prevent injury should it give way. Only one man must pull on the hook.

When all the foetal waters are discharged, an infusion of a large amount of warm water must first be administered, before reposition is attempted, this procedure rendering it much easier (Franck-Göring).

Should reposition be impossible, one or two fore legs are removed subcutaneously, thus gaining sufficient room to reach the head. The obstetrician should know the exact state of affairs, especially in this abnormal presentation, and take care that traction is not exerted on the head with a rope passed on the outside of the legs. One usually rejoices when the lower jaw is corded, and forgets that the head must be drawn up between the fore limbs. After pulling repeatedly and without success, the idea suddenly strikes us to pull in the right direction—that is, between the fore legs—and to repel the calf at the same time.

*The head turned backward and upward.*

This malposition is not often met with in the calf. The slow rotation and the short neck prevent it to a certain extent.

*Diagnosis.*—The fore legs lie in the vagina, the tracheal portion of the neck opposite the pelvic inlet, the lower jaw against the rectum. The best guides are the larynx and tracheæ of the foetus. The short neck always renders the head accessible.

*Prognosis.*—When the examination reveals that the superior vaginal wall is not injured by previous manipulations, prognosis is favorable.

*Treatment.*—Reposition by hand is possible in many instances. For this purpose the lower jaw is grasped by the fingers and an assistant repels the calf by the fore legs. Now, by drawing the hand toward the vulva, the head enters the pelvic canal; a loop may also be placed around the inferior

maxilla. The calf is then repelled by resting the hand against the sternum while moderate traction is exerted upon the rope, thus bringing the head into the parturient passage.

These manipulations are usually successful, so that a hook may be dispensed with. But when the owner or some other empiric has severed the body of the lower jaw, or when the head is turned to one side, that only the eye but not the mouth is accessible, a hook will have to be inserted into the orbital cavity.

It is often stated that, especially in malpositions of the head, greater force can be exerted with a hook than with a loop around the inferior maxilla. While this statement is correct in itself, we must remember that strong traction is neither necessary nor desirable. Many a one has drawn a head into the pelvic canal by means of two men, which could have been brought there without one-fourth the expenditure of force, provided sufficient room for reposition had been present; this favorable condition could have been obtained by repelling the calf and replacing the foetal waters by warm water to overcome the aspiration force of the uterus.

(d) ABNORMAL POSITIONS OF THE HEAD AND FORE LEGS.

The varieties of these complicated positions of the anterior extremity of the body are numerous. The general rule is: anything within reach of the hand is corded; the fore legs at the coronet or above the fetlock, the head around the lower jaw. It is mostly easier to fix first the head by placing a loop around the inferior maxilla, and next to adjust the legs. As soon as the latter are corded the head is guided along the fore legs into the pelvic canal.

(e) THE POSTERIOR EXTREMITY OF THE BODY IN THE PARTURIENT PASSAGE AND ABNORMAL POSITION OF ONE HIND LEG.

When the calf presents itself in the abdominal position, with both hind legs in the pelvic canal, parturition may take place without assistance, as it is a normal presentation.

In fact, this presentation is a favorable one for large calves, since by pulling on one leg the trochanters pass obliquely through the pelvic canal, after which the other foetal dimensions rarely form an obstacle; but in the anterior presentation the trochanters occasionally cannot pass the pelvic inlet after one-half of the calf is born.

When one or both hind legs are turned against the belly, expulsion is in most cases impossible. It is only possible when the calves are small or the pelvis wide.

*Causes.*—Insufficient dilatation of the cervix uteri, incomplete rotation, respectively accommodation, at the pelvic inlet in consequence of feeble pains, as seen in twin-pregnancy and an excess of foetal waters. Violent pains, with too early discharge of the foetal waters, may also produce this malposition.

*One hind leg retained, the fetlock lying below or against the symphysis.*

*Diagnosis.*—The hind leg lies in the parturient passage, the exterior surface of the leg is turned toward the floor of the pelvis, the plantar surface of the claw is directed upward.

The hand introduced into the vagina feels the fetlock turned upward, and the tendo Achilles, further on the tail, the postero-external angle of the ischium, below the gluteal muscles, and the fetlock of the retained leg in front of the anterior border of the pubis.

When the owner exerts strong traction upon the hind leg normally presented, its hock is found in the vulva and the pelvis of the calf in the pelvic inlet.

In this abnormal presentation the greater part of the foetal waters are usually evacuated.

*Prognosis* is favorable.

*Treatment.*—Small calves, as seen in twin-pregnancy or abortion, are occasionally extracted by the owner on the presenting hind leg in spite of the malposition. In such a case the retained leg is firmly pressed against the belly and the femur and tibia are extended on the long axis of the body.

Should the obstetrician attempt extraction under such circumstances, it is necessary that the calf is small and the pelvis wide, and that the retained leg is pushed forward as much as possible.

Nevertheless, it is much better to practice reposition, especially when the calf is small, as adjustments are more readily made in them than in large foetuses. After locating the parts, the fetlock of the retained leg is grasped with the hand and drawn, if possible, as far as the pubis. Now the whole hand is placed against the posterior surface of the tarsus, pushing

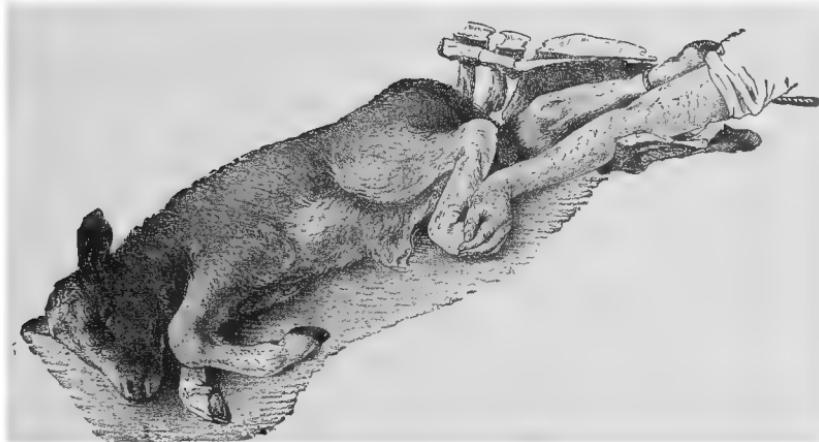


Fig. 42.—One Hind Leg Retained.

the leg upwards and repelling the calf at the same time. The hand now glides down along the shin, holding it firmly, flexes the fetlock, and draws it into the pelvic canal, holding the fetlock, coronet and claws in the hand (fig. 42). The greatest difficulty consists in the fact that the calf's buttocks enter the pelvic inlet with each pain, thus interfering with the retraction of the leg. In order to overcome this and to render reposition possible, the following treatment has been recommended:

1. Reposition should be performed in the standing cow with her hindquarters raised.
2. The calf is repelled with the obstetrical crutch.

3. An assistant repels the calf while the operator adjusts the retained leg.

Anybody correcting this malposition for the first time must pay special attention to point 2. When the calf is to be pushed back by an assistant, he should place the hand against the ischium, so that the thumb and index finger are on either side and below the tail. The assistant uses the right, the obstetrician the left arm, or *vice versa*. The assistant, when able to reach the fetlock of the retained leg, should press it upward and forward. The obstetrician seizes the strongly flexed fetlock, and, by drawing the hand toward the vulva, guides the leg into the pelvic canal. When reposition by hand proves impossible, the fetlock of the retained leg may be looped. Now the calf is repelled by pressing with the hand the fetlock upward and forward; traction is at the same time practiced on the cord and the leg enters the pelvic canal.

Should all the methods previously mentioned fail, the cow is placed into a dorsal position, also raising the hindquarters. The retained leg is then mostly accessible and, if necessary, the fetlock is corded. *Severe traction* must not be employed here, in order to draw the leg into the pelvic canal. The hand not engaged in the vagina does the pulling, and an assistant is not to be trusted.

Should the uterus here descend to the extent that the retained hind leg cannot be reached when the cow stands or lies on the side, the dorsal position is to be employed.

*One hind leg in the parturient passage, the other flexed at the hock in the pelvic canal.*

(Unilateral hock presentation, Harms.)

*Diagnosis.*—One-half of the metatarsal bone of one hind leg projects beyond the vulva. On exploration, the flexed tarsus of the other hind leg is felt, its tibia lying toward the pelvic outlet and the shin-bone firmly against the floor of the pelvis.

This position is usually produced when the owner pulls on the hind leg normally presented, while the hock of the retained leg was resting upon the anterior border of the pubis.

*Treatment.*—The calf must be cautiously repelled, the hand raising the tarsus of the retained leg as much as possible. In this way rupture of the vaginal floor is presented. Should retropulsion succeed and the hock be removed from the pubis, the last named presentation is produced.

When retropulsion is impossible and the calf dead, the hock of the retained leg is severed with the chain-saw. The shin-bone and parts below it are removed by hand, and the lower extremity of the tibia corded. While extracting by means of the hind leg normally presented and tibia, the stump of the latter is to be covered with the hand.

In place of a chain-saw an iron wire may be used to cut through the joint.

In small calves the hock may be drawn into the vulva, exarticulating it there with the knife, placing a thin cord around the lower extremity of the tibia.

One may also try to cut the tendo Achilles. In consequence of it, the shin-bone can be placed against the tibia, and more room is obtained.

*One hind leg in the parturient passage, the other hind leg flexed completely against the abdomen.*

*Diagnosis.*—The normal hind leg extends far into the pelvic canal. Slight pulling draws its hock into the vulva. On internal examination one feels the tail, postero-external angles of the ischium and the buttock of the retained leg opposite the pelvic inlet. The tarsus lies way below the pubis.

*Treatment.*—Small calves can be extracted in this abnormal position. The hind leg lying in the pelvic canal is pulled at, pushing the ischium of the calf to one side at the same time. In this way the greatest diameter of the hindquarters is rendered parallel to the height or greatest diameter of the pelvic inlet.

In most cases, reposition of the retained leg becomes necessary. For this purpose it is placed into the first presentation, by pulling the hock upon the pubis. This manipulation may be executed by seizing the tibia with the hand and draw-

ing it toward the operator. When the tibia is beyond reach the cow is placed into the dorsal position, the retained leg now being on top and more accessible. When the fetlock is directed toward the pubis and the metatarsal bone within reach, the latter is grasped by the hand, placing the thumb upon the flexed tendons. The thumb now presses the leg upward and forward, in consequence of which the calf descends some, the hand glides down to the claws and draws the leg into the genital canal. This reposition is easiest with the cow in the standing posture. When an assistant can repel the calf with the arm, more room is gained for work.

As long as the calf lives everything must be done to effect reposition.

After the calf is dead and all the foetal waters have been discharged, and consequently the uterus contracted firmly, a great deal of warm water may be introduced into the uterus, and another attempt made to adjust the leg. Should everything fail, one hind leg may be removed at the hip-joint and parturition finished by pulling on the leg normally presented.

#### (f) ABNORMAL POSITION OF BOTH HIND LEGS.

Both hind legs may be abnormally presented. Both hocks may be below or opposite the pubis, both in the pelvic canal with claws turned toward the uterus, or both hind legs lie close against the abdomen.

The first named presentations are treated as already suggested, only the latter, both hind legs completely retained and turned against the belly, require a detailed discussion.

This malposition is frequent, often causing dystokia, as the foetal waters are usually evacuated when we are called. The uterus is then moulded upon the calf and interferes with our attempts at reposition.

*Diagnosis.*—The history is that parturition has been going on for some time, and that it is usually uncertain whether the water-bag has ruptured or not. The continuous but not strong pains have not advanced any part of the foetus as far as the vulva, excepting possibly the tassel on the tail. Internal ex-

amination reveals the tail in the vagina, the posterior extremity of the calf in front of the pelvic inlet, recognized by the buttocks, the root of the tail and anus. Further ahead the sacrum is felt, laterally the trochanters and the posterior gluteal muscles just in front of the pubis. Advancing further yet the hock can be reached by following the tendo Achilles and sometimes the metatarsal bones (fig. 43).

The parts are best located while the cow is standing.

*Prognosis.*—When the calf is still alive and the foetal waters not yet completely discharged, so that the uterus is not too firmly contracted, the prognosis is favorable. But when the foetal waters are evacuated, the calf dry, the uterus moulded



Fig. 43.—Both Hind Legs Retained Under the Body.

upon the calf, the prognosis must be doubtful, as the uterus may rupture *without it being the fault of the obstetrician*.

*Treatment.*—It occasionally happens, that in this presentation very small calves or twins may be extracted by pulling on the tail. Nevertheless, it is impossible in most instances. In case strong traction is applied, it is best to use the so-called Saake's loop.

An ordinary rope with a loop is carried in front of the retained legs, and patella, from one side to the other. The hand now seizes the loop and draws it outside the vulva; at the same time the other end must not be turned loose. The pointed end

of the rope is now run through the loop and the loop thus made is pushed by the thumb and forefinger over the loins of the calf and is drawn tightly. This loop, lying around the flanks and belly, will stand strong traction.

Harms recommends blunt hooks, 17 cm. long and 15 cm. wide, having an ear on the lower end. They are placed in front of the patella. A rope is run through both ears, when the calf is ready for extraction in this malposition.

Large calves cannot be extracted in this manner. In small calves reposition is possible, requiring the same efforts as the application of the loop. It is better to effect reposition of the retained legs in the manner already mentioned. The leg which has been guided into the pelvic canal must always be fixed before the other one is adjusted. When the uterus is firmly contracted upon a dead calf, no time should be lost with attempts at reposition, but partial embryotomy is indicated. This confines itself to *the removal of the hind legs from the hip-joints.*

As soon as the hind legs are drawn out the calf may be extracted by the flaps of skin or by blunt hooks placed into the oval foramen or in front of the pubis.

## 2.—COSTAL PRESENTATIONS.

These belong to the abnormal positions, where the thoracic wall lies opposite to the back of the mother. The costal portion may be present both in the anterior and posterior presentation.

*Causes.*—In the beginning of the pains, when the cervix uteri is not yet completely dilated, the costal position of the calf is normal, being the intrauterine presentation. Therefore, in those cases where rotation is incomplete, the calf may enter the parturient passage on its side, especially when the uterus is distended and the pains feeble.

*Diagnosis.*—In the anterior presentation the skull is turned toward the lateral wall of the vagina, the fore legs and the plantar surfaces are directed laterally.

*Treatment.*—When the anterior extremity of the body has not yet passed into the pelvis, the head is drawn upon the fore legs into the parturient passage; the balance of the calf then places itself into the abdominal position.

When head and fore limbs are already in the vagina, traction is exerted on the uppermost leg of the calf while the cow is down. For instance, the calf rests on the right side, as also the cow; in this case one pulls on the left fore limb of the calf. By doing so a quarter rotation and extraction is now possible in the abdominal presentation. When the posterior extremity of the body lies on the side, traction is exerted until the trochanteric diameter passes the height of the pelvic inlet. This is often followed by spontaneous rotation, as the sternodorsal diameter of the thorax accommodates itself to the greatest diameter of the pelvic inlet—that is, its height. Besides this, numerous other abnormal positions of the head, fore legs or hind legs are seen; they are converted into the preceding presentation.

### 3.—DORSAL PRESENTATIONS.

We speak of a dorsal position when the back of the calf is turned toward the abdomen of the parent. It is not frequently seen in the cow, but occasionally causes dystokia. The dorsal presentation may be complicated by malpositions of the head, fore legs and hind limbs.

*Diagnosis.*—In the dorsal presentation, with the head and fore limbs lying in the parturient passage, the anterior extremities rest with their flexion surface toward the inferior wall of the vagina. The plantar surface of the claws is turned upward, making the impression at first as if the hind legs are in the pelvic canal.

Should the hind legs occupy the parturient passage, their anterior face is turned toward the roof of the vagina and the plantar surface of the claws downward. The owner usually imagines that the fore limbs are in the pelvic canal and that the head is turned backward.

The diagnosis is not difficult. In the first instance we define the position by the head lying under the fore legs, in the latter by the hocks and tendo Achilles.

*Treatment.*—As long as no part of the calf has entered the pelvic canal, treatment is simple. The head is placed upon the fore legs by placing the hand against the head and turning it. The fore legs are fixed and a loop placed around the lower jaw. After the head is once placed upon the fore limbs the calf turns by itself. When the hind legs have passed into the pelvic canal in the dorsal position, they are pushed back, and rotation around the long axis is attempted, by introducing the hand between the hind legs of the calf as far as the symphysis.

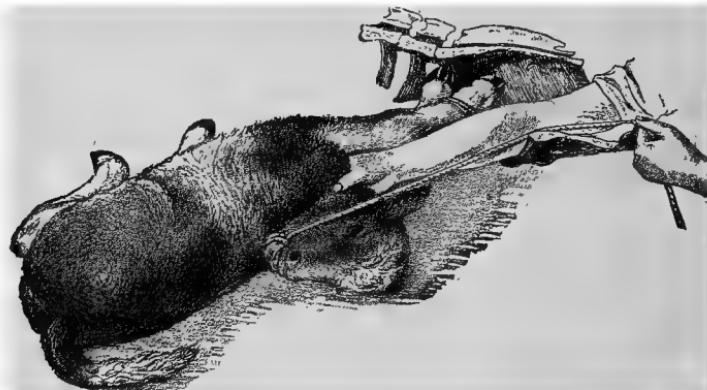


Fig. 44.—Dorsal Position, with the Head Turned Back.

One hand now fixes the hind legs, the other twists the hind-quarters; also, by placing one leg across the other one and pulling on it, rotation of the calf can be effected.

*Dorsal presentation with two fore legs in the pelvic canal, the head turned backward.*

*Diagnosis.*—Both fore legs lie with the claws in the vagina, the flexion surface turned upwards. On internal examination, one feels the sternum, anterior surface of the neck and usually the head, by gliding along the exterior surface of the fore legs.

The partial contraction of the uterus prevents the head from descending further.

*Treatment.*—The fore legs are fixed with loops above the fetlocks, in order to have them accessible at any time. A loop is placed around the lower jaw (fig. 44).

The cow is put into a dorsal position and then the head of the calf is placed on the fore legs, repelling the calf if necessary. All three cords are tightened and the cow rolled on the side. In many cases rotation has now progressed sufficiently so that the dorsal position is converted into a costal one.

Rotation may be assisted by pressure with the open hand against the scapula. When the calf is dead and the uterus firmly contracted, warm water may be introduced into the uterus and reposition tried once more, or embryotomy is performed.

Usually the subcutaneous removal of one or both fore legs is sufficient. The head may then be drawn into the pelvic canal and parturition finished according to rules previously laid down.

*Dorsal presentation with retained fore or hind legs.*

The treatment endeavors to establish a dorsal position, where head and fore legs or hind legs get into the parturient passage. This reposition is easy by placing the cow on the back. After that the case is treated as an ordinary dorsal presentation.

## II.—TRANSVERSE PRESENTATIONS.

In this abnormal position the long axis of the calf forms an angle of 90 deg. with the long axis of the mother.

The dorsal as well as the abdominal region may be turned toward the pelvic inlet. Therefore, we recognize transverse dorsal and transverse abdominal presentation.

### TRANSVERSE DORSAL PRESENTATION.

It is more frequently met with in cows which have calved repeatedly than in primiparæ. The withers as well as the

lumbar region may be turned toward the pelvic inlet. The calf does not always lie horizontally; the hindquarters usually lie deeper.

*Diagnosis.*—On examination, one feels an extensive smooth surface, occasionally the hairy skin, when many manipulations have been performed and the foetal envelopes torn.

In this abnormal presentation it is not always easy to make a correct diagnosis, especially when the calf is hard to reach. In such a case it is advisable to raise the cow's abdomen by means of a board, or to put her on the back. To make the diagnosis, the ribs, ligamentum, nuchæ and external angles of the ilium are located; sometimes the tail or ears are accessible.

*Treatment.*—This depends on the part within reach. Should one be able to seize the tail, the hind legs must be brought into the pelvic canal. Since the calf is almost always dead, a small hook with a rope is passed through the anus into the oval foramen when the hindquarters cannot be moved by the hand. While one hand pulls on the rope the other rests upon the hook.

As soon as a longitudinal position with the hind legs abnormally presented has been produced, the rules applicable to it are employed.

Whenever possible the hindquarters with the hind legs are drawn into the parturient passage, preventing a malposition of the head.

When the anterior extremities are more accessible, either the head or one of the fore legs, delivery in an anterior presentation is attempted by adjusting the head or fore legs.

Whatever the hand can reach must be corded to be accessible when needed. The aim of reposition is to convert this presentation into a longitudinal one, be it abdominal, dorsal or costal, with the anterior or posterior extremities in the parturient passage. After that a normal presentation is effected according to the rules already given.

## TRANSVERSE ABDOMINAL PRESENTATION.

In this abnormal position the abdomen of the calf is turned toward the pelvic inlet of the cow. This presentation may be varied.

*Transverse abdominal presentation with fore and hind legs in the pelvic canal.*

This abnormal presentation is rare in the cow. The fore legs usually have advanced further into the pelvic canal than the hind limbs. On examination, one feels three or four legs, so that doubt may arise whether twins are present or not. A

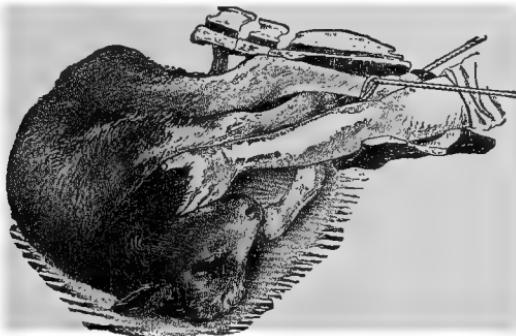


Fig. 45.—Transverse Position.

very thorough examination is to be made, extending to the position of all the parts of the foetus.

*Treatment.*—The hind legs are fixed by looping the fetlocks. The cow is either raised behind or made to stand up. Now the fore legs are repelled as much as possible and the carpi flexed as soon as they pass the anterior border of the pubis.

By placing the left hand against the shoulder with the thumb behind the elbow and the four fingers upon the scapula, the anterior portion of the body is pushed back, and by pulling at the same time on the hind legs the transverse presentation is changed into a longitudinal one with the hind legs in the pelvic canal (fig. 45).

The right hand guides the assistant in which direction he must pull. When the anterior extremities of the body cannot be repelled, one or both fore legs are removed subcutaneously.

*Transverse abdominal presentation, the legs not in the pelvic canal.*

In this position one usually deals with small calves. The cervix is almost invariably incompletely dilated. The fore legs are flexed at the carpi, the hind legs extended under the body. The treatment attempts to bring the hind legs into the pelvic canal. But there are transverse abdominal positions where two or three legs lie in the pelvic canal. These are recognized and treated according to the rules previously given. It happens that the fore legs lie in the vagina and the head in the pelvic inlet while the claws of the hind legs rest upon the symphysis. This abnormal presentation, designated by Harms "dog-sitting position," is rarely observed in the cow.

When the owner pulls on the fore legs until the head appears between the labiæ and the shin-bones of the fore legs project at the vulva, repulsion becomes impossible or very difficult.

In the first case the foetus is divided and rotated by means of the hind legs.

In the earlier stages of parturition, when repulsion of the calf is possible, the hind legs are pushed away from the pubis and the anterior extremity of the body is brought into the pelvic canal.

It is always advisable to make an exact diagnosis of this abnormal presentation and to search for the claws or hind legs along the floor of the vagina, as this presentation may be confounded with retarded birth depending on ascites.

*Abnormal presentations of twins.*

In malposition of twins, parts of one calf may enter into the parturient passage together with parts of the other calf, thus interfering with parturition.

This may give rise to various conditions. Thus the head of one calf with the fore limbs of the other calf, or one of its

own fore legs or that of the other calf, may enter at the same time. In the same manner three or more legs with or without a head may appear together in the pelvic inlet.

*Diagnosis.*—The diagnosis is best made by locating the carpi, elbows, sternum; on the hind legs, the hocks, tendo Achilles and tail. No definite indications can be given here. It is absolutely necessary to make a correct diagnosis with regard to extraction.

*Treatment.*—Since the calves are mostly small, reposition is easy. The fore legs of the calf which is most forward are fixed; the lower jaw is also looped. The parts of the body of the second calf, fore, hind legs or head, are repelled, and the first calf extracted.

When two hind legs of a calf enter the pelvic canal they are fixed by loops above the fetlocks. This calf is now extracted first, while the other one is repelled.

The attempts at reposition are not very difficult, since as a rule only feeble pains accompany multiparous pregnancy. Occasionally it happens that the owner pulls on the fore leg of one calf and the fore leg of the other calf, thinking he is dealing only with one calf. Then fore legs and head are wedged in the vagina. In this case the calf must be repelled to make a diagnosis; before doing so head and fore legs are corded so they may be readily drawn into the pelvic canal.

## DISMEMBERING OF THE FŒTUS (EMBRYOTOMY).

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*History.*—According to Thomassen, Columella is supposed to have been the first one who mentioned embryotomy, in the seventh volume (sheep-breeding) of his work.

Already in the year 1597 Colerus, in his treatise on breeding and diseases of the domestic animal, advises to call a shepherd in dystokia of sheep, so the young may be delivered as a whole or in pieces.

Eberhard, physician at Zeist (Holland), in 1793 gives in his work a method how to perform embryotomy. He enjoyed instructions in 1778 under Kersting at Kassel. Fromage mentions Texier senior in 1806, that he repeatedly removed a fore leg of emphysematous calves by forcibly pulling the leg off the body.

Le Francq van Berkhey first mentions two obstetricians who dismembered the calf subcutaneously, viz.: J. Blanken and J. Lauwen. They used a spatula and a short finger knife.

G. Wit reports that the practitioners P. Knip, father and son, at Beemster, North Holland, first employed the curved spatula to skin the head. Both of these obstetricians were famous in Northern Holland on account of their dexterity in embryotomy. The father performed 1,400 embryotomies from 1811 to 1855, the son 500 in 15 years.

Knip and son became so dexterous in embryotomy by first practicing it on dead calves by introducing the arm into the hole through which the urine of the stable was discharged. The calf was lying in the stable, while the obstetrician, after subcutaneous removal, withdrew the various parts through that opening.

Skellett in 1811 removed the head and fore legs of a calf without injury to the parent.

Jörg, who reported this in 1818, remarks that it is impossible to handle a knife inside the uterus without injuring it, on account of the restlessness and straining of the mother. It, therefore, would be best to slaughter the animal early.

S. Fey in 1823 already recommended to repel the head and push it downward toward the udder so that the nose rests against the pubis, should the head resting on the fore legs enter the parturient passage. The fore legs are removed with a curved hook and knife by severing the skin around the scapula. For extractions he uses forceps. In the handle of the curved knife was a hole through which a rope was drawn. Whenever desired by the operator, an assistant could pull on it and assist in the operation. Fey further states that he saw this knife used in 1812 in Cantons Glarus, St. Gallen, Zug and Gasterland in dismembering calves within the cows without the least injury to the mother.

Günther in 1830 describes in his work incisions as well as the subcutaneous method in regard to the removal of a fore leg.

Huvelier in 1830 describes the removal of the fore limb of a calf with the head turned to one side. He made a circular incision through the skin in the middle of the shin-bone, split it on the internal surface of the leg as far as the breast, separated it with a bistoury, or better, with the hand, up to the shoulder; made a few rotary movements with the leg, corded the fetlock, when the leg could be torn off by an assistant. He introduced both hands into the uterus to exert counterpressure on the foetus.

Veret, quoted by Wit, in 1837 placed a rope around the hindquarters of the parent above the hocks and had assistants hold it. The leg of the young which is to be removed is corded and fixed, the skin above the fetlock receives a circular incision and is split upward. Now the skin is separated and the leg pulled off by drawing on both ropes in an opposite direction.

Since that time important communications about embryotomy have appeared by Rychner, Baumeister, Franck, Harms;

in Belgium, by Delwart, Brogniez, Defays, Deneubourg, and Thomassen; in France, by Schaack, Rainard, Zündel, St. Cyr and Violet; in England, by Cartwright, Nelson, Fleming; in Italy, by Cattaneo, Sacchero (Thomassen), Lanzilotti-Buonsanti; in Sweden, by Sjöstedt; in Holland, by Van Setten, Numan and Wit. The school at Utrecht is under obligations to the latter, that since 1851 a course in embryotomy on the phantom is given.

*Definition.*—By embryotomy is understood the dismembering of young in the uterus. It is performed in those cases where extraction of the whole foetus is impossible, either because it is too large or because the parturient passage is constricted.

*Indications.*—Embryotomy may be indicated:

(a) *In the Foetus Absolutely too Large.* Here belong the double-ender and some monstrosities; of the latter, most are double monstrosities. A partial or complete embryotomy may be also necessary in hydrocephalus, anasarca and emphysema of the foetus. The parturient passage has a normal diameter, but the foetus is too large, so that it cannot be extracted without dismembering it.

(b) *In the Foetus Relatively too Large.* The young is normally developed and has the ordinary dimensions. The pelvic canal is too narrow, prohibiting the normal passage of the calf. This indication refers to pelvic constrictions, frequently seen in the juvenile pelvis or in consequence of rachitis. Exostoses and callus formation in the pelvic canal also may diminish the diameter of the pelvic inlet or passage.

(c) *In abnormal presentations of the calf,* where neither reposition nor extraction in the abnormal position is possible. This suggests that here embryotomy is frequently indicated while in reality its number is limited. The empiric is quickly inclined to see this indication and immediately performs embryotomy. The rational obstetrician attempts reposition with all the means at his disposal, usually succeeding in it. In an abnormal presentation, embryotomy is only then indicated when all endeavors at a reposition prove futile.

### 1.—General Rules for Embryotomy.

Embryotomy under certain circumstances is a pretty dangerous operation for the parent. In itself it is not dangerous, but when birth is protracted complications may follow which endanger the life of the cow. The measures to be taken in each case serve to prevent these complications.

*The cow must lie on the right side.* Embryotomy ought not to be performed in the standing animal. It is dangerous to operate with long instruments when the calf's position deviates from the line of extraction. The position upon the right side is necessary on account of the diagonal position of the rumen. This pressure is transmitted to the diaphragm and causes dyspnoea. The weight of the calf also interferes with the function of the rumen and may give rise to tympanitis.

*The hindquarters of the cow must be raised;* anyway, they should not be lower than the anterior extremity of the body. These are elevated by placing two bundles of straw transversely beneath the hind legs, each bundle being tied with three cords. This elevation is of advantage to the operator, as the calf is not pushed against the pelvic inlet.

*The operation, whenever possible, should be performed within the uterus,* and not in the pelvis. Since the various manipulations demand room, the parts wedged in the pelvis must be repelled. When it is possible to draw parts to be removed outside the vulva, it should not be omitted.

The obstetrician must practice to operate with the hand as much as possible. After some practice, the skin can be separated on many places by hand.

To perform embryotomy but few instruments are required. Anyone used to operate with a limited number of instruments often obtains better results than he who employs complicated instruments. A great deal depends on the instruments one is used to handling. The main thing is a systematic execution, according to a rational plan to be developed for each case.

Traction should be exerted by one assistant. The obstetrician must not pull. He must spare his energies for the

difficult and fatiguing task. In most cases one person suffices to extract the various parts of the calf. The force which he exerts amounts to about 100 kg.

*Whatever has once been started must be finished.* Anybody not immediately successful when performing embryotomy must beware of cutting here and there. A regular course must be followed; for instance, when a fore leg breaks off at the elbow joint one must not start to remove the other fore leg, leaving the humerus and scapula of the former one. It matters not how tedious and painful the task, anything we once conclude to remove must be entirely removed and no half work permitted.

Anybody living up to these rules becomes an expert obstetrician in due time; but anybody changing his system constantly never becomes competent.

## 2.—The Instruments for Embryotomy.

As the historical review shows, certain cutting instruments have been employed early to remove parts of the calf. Thus Günther describes a curved finger knife and a sliding bistoury. Both are still to-day very useful instruments.

A knife which I use frequently is seen in figure 46. Franck-Goring termed it a modified finger knife of the Vienna collection.



Fig. 46.—Finger Knife.

Fig. 47 shows Günther's sliding bistoury; by sliding the knob backward, the knife can be introduced within the handle.

Karl's embryotome is a finger knife with a cross-piece. The latter has such a shape that one end rests between the thumb and index finger, the other upon the little finger.

A useful finger knife is shown in fig. 48.

Dopheide's embryotome (fig. 49) is not as useful as the preceding ones. It is my opinion that it is of little use in practice.



Fig. 47.—Gunther's Bistoury Caché.

Spatulas are employed to separate the skin from underlying parts. They are used a great deal in embryotomy.



Fig 48.—Finger Knife.

The small spatula, 27 cm. long, is used to separate the skin on the fore legs as far and above the carpus, and on the hind legs as far as the hock. This is done before the large spatula is employed (fig. 50).



Fig. 49.—Dopheide's Embryotome.

The large spatula, 72 cm. long, has the same shape as the small one, its wide end being also blunt. Its handle shows a crutch. The wide end is slightly concave in the middle (fig. 51).



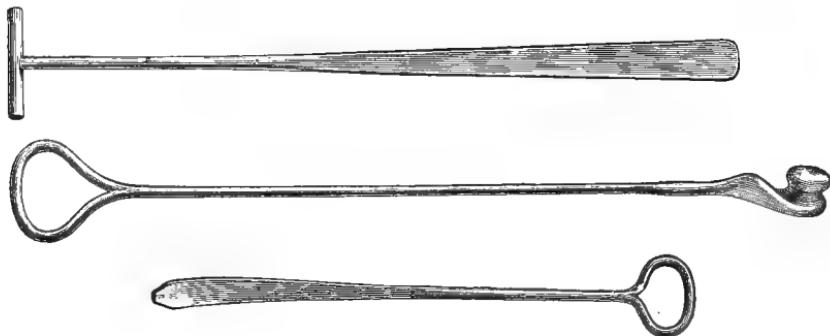
Fig. 50.—Small Spatula.

A large spatula, a modification of the above, is the so-called heart-shaped spatula, its wide end being heart-shaped.

In order to tear at the same time connective tissue the

heart-shaped portion of the spatula shows a notch laterally. This acts like a sharp hook when the instrument is retracted.

The curved spatula is mainly used to skin the head (fig. 53.)



Figs. 51, 52, 53.—Large, Heart-shaped and Curved Spatulas.

The skin knife, one of the most useful instruments, is used in the removal of the fore and hind legs and when the skin is to be cut within the vulva. It consists of an iron rod with a handle on the lower end. The other end exhibits two lips of unequal length; between them is a knife with the cutting edge upwards (fig. 54).



Fig. 54.—Skinning Knife.

When using it the large lip is placed into the skin wound in the direction in which the skin is to be split. The inserted end of the instrument is covered with the left hand, and by pushing the instrument with the right hand the skin is cut. While cutting, an assistant tightens the leg.

Hooks are often used in embryotomy either to tear or extract certain parts of the body. At the same time no hooks are used when the same result can be obtained by cording the parts. Short and long hooks, blunt or sharp, are employed. The short hooks, 12 cm. long, have a ring on the straight

end, to which a rope is fastened by means of which an assistant may pull (figs. 55*a* and 55*b*).

Fig. 55*a*.Fig. 55*b*.

Short Obstetrical Hooks.

The long hooks, excepting the long sharp hook, are less frequently used in embryotomy. They are 60 cm. long, the straight end being provided with a crutch for traction (figs. 55*c* and 55*d*).

Fig. 55*c*.—Long, Dull Obstetrical Hook.

The long sharp hook is a very useful instrument when probe-pointed to dissect the foetus. The annexed figure

Fig. 55*d*.—Fabricius's Obstetrical Hook.

represents such an instrument (fig. 56*a*). The concave portion of the segment forms the cutting edge. This hook has the advantage not to cut the skin when slipping, thus preventing

Fig. 56*a*.—Long Sharp Hook.

injury to the uterus or vagina. Hubenet (Holland) placed a guard in front of the cutting edge to protect the parent and finger in case it should slip off (fig. 56*b*).

Kruijt's embryotome (Holland) is a convenient instrument for anybody having some practice. It is 60 cm. long, its seg-

ment being 4 cm. wide. It is not probe-pointed, but the cutting edge is more concave (fig. 56c).

The embryotome to sever the vertebral column consists of a rod 60 cm. long, having a cross-piece with a cutting edge on the end. After separating the skin with a spatula, the crutch is



Fig. 56b.—Hubenet's Hook.

taken into the right hand while the other end is passed with the left hand beneath the skin. As soon as the spot to be severed is reached, the hand, by pressing upon the blunt part



Fig. 56c.—Kruijt's Hook.

of the cross-piece, drives the knife into the muscles. Rotary movements are made with the right hand on the crutch while the left hand presses the knife into the muscles and between

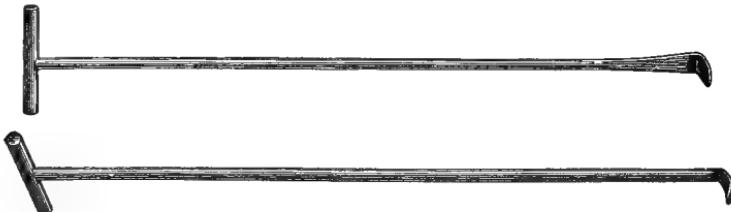


Fig. 57 and 58.—Knife to Sever Vertebral Column.

the vertebræ, destroying the connection between them. The cross-piece is placed on the opposite side to accommodate those mainly operating with the left hand.

R. Boer Hzn (Holland) has modified and improved this embryotome. The crutch is more oblique and the cutting edge has also been changed (fig. 58).

The vertebral embryotome is employed to amputate the neck, dorsal or lumbar region. According to Boer, it may also be used to sever muscular tendinous tissue around the scapula, coxo-femoral articulation.

The first to introduce the saw into obstetrics was the Hollandish veterinarian, J. H. Hinze, at Mijdrecht. It consists of a rod 72 cm. long, with a sawing surface (14 cm.) on one end (fig. 59).



Fig. 59.—Saw with Handle.

It is used to cut through the body of the inferior maxilla, temporo-maxillary articulation, the ribs, the sacro-iliac articulation and the ischio-pubic symphysis.

The long sharp hook, the vertebral knife, and Hinze's saw are only employed in subcutaneous embryotomy. They are only of use when the skin has been previously separated to quite some extent by the hand or spatula. The hand, which always covers the instruments, lies underneath the skin.



Fig. 60.—Chain Saw.

Persson introduced the chain saw into obstetrical practice. Sjostedt described it in 1875 in his "Handbok i Förlossingskonsten." On each end is a ring to fasten a rope (fig. 60). The chain saw is convenient to remove the head, to cut through legs abnormally presented; for instance, a carpus wedged in the vagina with the leg turned backward. The chain saw may also be employed to cut contractions of the neck and the sacro-iliac articulation in subcutaneous embryotomy.

Oehmke constructed a short saw which is very practical (fig. 61).

The chisel (fig. 62) is used in subcutaneous embryotomy to separate the branches of the inferior maxilla, the thorax, the sacro-iliac articulation, a curved neck and symphysis pubis. To use it, the obstetrician's hand carries it to the part to be cut, while an assistant drives it with light blows from a wooden mallet through the bones.



Fig. 61.—Finger Saw.

Instead of the chisel, the sharp heart-shaped spatula may be employed to split the ischio pubic symphysis. It is introduced by covering it with the hand, and is placed against the symphysis. A light blow with the other hand against the free portion drives it into the cartilage. By further twisting and pushing it, the symphysis is separated. Forceps serve to



Fig. 62.—Embryotomy Chisel.

extract portions of the foetus after the skin has been separated; for instance, the branches of the jaw, the neck, the thoracic wall, the dorsal and lumbar region, the sacrum and one half of the pelvis. They may be dispensed with when we accustom ourselves to use the sharp probe-pointed hook and the rope. Kruijt, André and Van der Linden have constructed useful forceps for embryotomy.

### 3.—Partial Embryotomy.

*Indications.*—Partial embryotomy confines itself to removing certain parts of the calf, to render possible the passage of the balance of the body. It is indicated when certain foetal diameters exceed the pelvic dimensions. When the bicostal

diameter is excessive, one or both fore legs are amputated, thus allowing the thorax to pass the parturient passage. This wedging of the calf is frequent. The head and fore legs rest in the vagina, and the withers in front of the pelvic inlet.

When the hind legs lie in the pelvic canal and the distance between the calf's trochanters exceeds the pelvic diameter, the removal of one hind leg and possibly one half of the pelvis of that side may be indicated.

Partial embryotomy is indicated in many cases. Those cases most frequently encountered in practice shall be discussed more closely.

Before doing so I wish to lay stress upon the fundamental rule: Operate subcutaneously whenever possible. Dismembering of the foetus is preferable to any other method. While it may take a little longer than the other method, that is, simple incision, where the skin is removed with the part of the body, it always has a greater tendency to lead to a more successful termination.

It is often astonishing how little the cow suffers by this operation, sometimes occupying three to four hours. It often happens that she lies quietly and ruminates while the surgeon operates. Embryotomy properly performed causes the animal little suffering. After it is finished she gets up, and in most cases but little after treatment becomes necessary.

The obstetrician has a serious task. He must be possessed of thorough anatomical and obstetrical knowledge, must act with judgment and show great endurance while operating. He must never be wanting in patience.

#### THE SUBCUTANEOUS REMOVAL OF ONE FORE LEG IN THE PELVIC CANAL.

The fore leg to be removed must lie in the parturient passage, the claws and fetlocks in the vulva. On exploration with the hand and arm, the whole leg as far as the withers must be within reach.

When head and fore legs lie in the canal, it is impossible to remove one fore leg for want of room. *The calf must be re-*

*peled*, and the head turned to one side or depressed between the legs. The other fore leg, if possible, is flexed at the knee and returned to the uterus. In this manner the leg to be amputated occupies the pelvic canal alone, and only thus can the operation be properly performed.

*Modus operandi*.—The coronet of the claw is looped and the rope, fastened to a round stick, is tightened by an assistant. The cord must be long enough so that the assistant does not interfere with the obstetrician's manipulations.

Now two longitudinal incisions, 8 to 10 cm. long, are made with the finger knife or bistoury at the fetlock, one at the inside, the other one at the outside of the leg.

The small spatula is next introduced into the skin wounds, the skin is separated over the shin and along the flexor tendons a little above the carpus, first on one and then on the other side. The spatula is to remain close to the skin and must not get between the flexor tendons, as it renders the work difficult. The movements of the spatula are followed by gliding the left hand over the skin.

After this the large spatula is introduced at first into the inner skin wound, while pushing the spatula ahead with the right hand, and following its movements with the left hand which glides along the skin, the integument is separated along the radius as far as the sternum, in front beyond the shoulder joint and behind as far as the extensor muscles. One operates with long steady strokes and no jerky movements.

The spatula is worked in the same way when inserted into the external skin wound, separating the skin as far as the withers over the whole scapula, until the easy movement of the spatula indicates that the parts severed from the inside have been reached. At this moment only a few connective tissue strips unite the skin with the parts below it.

Now the incision on the inside is prolonged as far as the elbow. For this purpose the skin knife is placed into the incision. By pushing the instrument ahead and covering its inserted end with the other hand, the skin is quickly split.

The hand is next passed underneath the skin, breaking loose all connective tissue fibres so that the ligamentum nuchæ above and the anconeæ muscles behind can be grasped. To facilitate extraction of the leg, the pectoral muscles and some common muscles around the scapula and the brachial plexus may be cut with the sliding bistoury or finger knife. Of course this is not necessary, but the operation is easily performed with the sliding bistoury underneath the loose skin.

Finally a circular incision is made through the skin at the fetlock, the loose skin is pushed up, the loop of the cord placed above the carpus, and the leg extracted by the assistant (fig. 63).

The main point in this operation is the thorough separation of the skin; the balance is easy.

#### REMOVAL OF THE HEAD (DECAPITATION).

It may be done in two ways, subcutaneously and with an open incision. Decapitation with the skin is best done with the chain saw.

For this purpose the head is secured with a loop around the lower jaw or by means of a hook in each internal canthus of the eye, to prevent its swinging to and fro while sawing. To start the saw well it is advisable to make a small incision behind the ears. Now the saw, which has a cord on each end, is introduced, pressed into the incision, and the operation begins.

It is well to watch the saw, as it may break when turning over. This operation is quickly done, requiring only a few minutes. This method is disagreeable, as it renders difficult the subcutaneous removal of the neck, as no skin flaps are pre-



Fig. 63.

sent by which the parts can be fixed, as in subcutaneous removal of the head.

#### THE SUBCUTANEOUS REMOVAL OF THE HEAD.

This difficult operation, which in most cases can be avoided and which is performed outside the vulva whenever possible, is performed as follows:

The head is fixed with a small hook, inserted into a cut on top of the nose. On both sides of the mouth along the external surface of the lower jaw the skin is incised and separated by the thumb and index finger. Now the spatula is introduced and the skin separated as far as the temporo-maxillary articulation over the masseter muscle. By gliding with the spatula over the inferior border of the lower jaw toward its internal face the tongue is freed.

The hand, resting upon the skin, always follows the movements of the spatula in order to prevent injury of the genitals should it slip down.

When the branches of the inferior maxilla have been separated in this way, the skin still adhering to the chin is cut with the bistoury. The probe-pointed sharp hook is placed under the skin and pushed as high as possible behind the posterior border of the lower jaw. After turning the instrument its edge is applied against the joint, and by pulling slowly the branch of the lower jaw is cut off close to the articulation. The body of the lower jaw is also severed with the hook or bistoury.

Each branch of the jaw is now loose and may be taken away with the forceps or loop placed around the jaw behind the molars. The tongue still lies on the skin.

The incision upon the nose is prolonged 5 to 6 cm. and the skin separated with the finger and thumb as far as possible; the small spatula is used as far as the eyes and curved portion of the skull. Now the curved spatula is introduced to separate the skin from the cranium and neck as well as behind and to the sides of the ears. This is a difficult piece of work, as here the skin is closely moulded to the parts. The spatula

sometimes must be twisted right and left to accomplish its purpose.

Now the ears and the skin around the eyes still remain. The former are cut off by passing the sharp hook underneath the skin and inserting it back of the concha; (care must be taken that the skin has been well separated previously).

After separating the skin between the eyes and ears with the curved spatula, the sharp hook is placed underneath the skin behind the eyelids, cutting them slowly. Finally the union of the buccinator with the alveolar border and lip is cut with the bistoury. The head is now only connected with the trunk by the occipitoatlloid articulation; otherwise it lies loosely in the skin. Exarticulation of the head is performed with the vertebral knife. It is carried with the hand along the hard palate closely behind the styloid processes, the cutting edge is placed laterally over the joint, the fingers pushing the knife downward. While twisting the handle with the right hand and pushing against the knife with the left one, the joint is entered. The knife now turns and severs the parts.

Finally the ligamentum nuchæ and cervical muscles are cut with a bistoury, when the head can be extracted by means of a hook.

The flaps of the skin are kept apart by two assistants by means of two ropes, one on each side, which have been run through the openings for the eyes. When necessary, the obstetrician may now remove the neck subcutaneously.

#### THE SUBCUTANEOUS REMOVAL OF ONE HIND LEG IN THE PELVIC CANAL.

When both hind legs lie in the parturient passage, but total extraction impossible, one hind leg is to be removed. It is not necessary to repel the other hind leg, as mostly ample room is present for the operation.

*Modus operandi.*—The hind leg to be removed is extracted as far as possible until the fetlock appears in front of the vulva. An assistant fixes it with a loop in the same way as it was done in the fore leg. The skin is incised on either side of the

fetlock to an extent of 8 to 10 cm. The skin is separated with the small spatula from the deeper parts above the hock. Here attention must also be paid to avoid getting between the flexor tendons and to remain just underneath the skin. Separation is a little more difficult along the posterior bones and tendo Achilles, but succeeds with some patience.



Fig. 64.

Now the large spatula is passed into the external wound to separate the skin a little beyond the patella or over the muscles of the croup as far as the sacrum, behind up to the posterior gluteal muscles. In the same way on the inside, in front up to the patella, behind a little beyond the semi-tendinosus muscle. While the right hand manipulates the instrument the left one follows its movements on the skin.

When the skin is separated all over, detected by the easy movements of the spatula below the skin, the skin incision on the inside is prolonged, splitting the skin as far as the patella. This is done with the skin knife in the same manner as in the fore leg. The largest projection is inserted into the skin; the left hand covers the knife and follows it, while the right hand pushes it forward.

Next the hand is passed under the skin to tear loose any connections not separated by the spatula. Should it be difficult here and there, the sharp probe-pointed hook is employed for that purpose. After the whole leg lies loosely in the skin, the sliding bistoury or finger knife is passed under the skin as far as the muscles of the croup, cutting them from before to behind as far as the joint. The incision through the muscles ought to be made as long and

deep as possible. Finally, the skin of the fetlock is circumcised, pushed up, and the loop passed beyond the hock. An assistant can now extract the leg from the skin with some force. In emphysematous calves the muscles need not be cut through. The leg may be extracted as soon as it is skinned (fig. 64).

THE SUBCUTANEOUS REMOVAL OF A FORE LEG RETAINED UNDER  
THE ABDOMEN.

This operation may be indicated when both fore legs are pushed under the body, with the head in the vulva, and when repulsion of the calf is impossible.

*Modus operandi.*—The head is secured with a loop around the lower jaw, or with a hook in the eyes, and extracted if possible beyond the vulva as far as the ears. The force of one man is sufficient for it. The head is skinned outside the vulva, exarticulated, removed, fastening a cord in each hole for the eye to enable an assistant to keep the flaps of skin apart. Next the skin of the neck is separated as far as the first ribs, by the hand or small spatula.

The union between the last cervical and first dorsal vertebræ is severed with the vertebral knife. A loop is placed around the neck and handed to an assistant, who can extract the neck from the skin.

The hand is now passed underneath the skin to separate it at the shoulder and to tear the muscles common to that region. The sharp hook may be employed. As soon as the shoulder is detached, the neck of the scapula is corded, passing the rope to an assistant for extraction. Finally the foreleg is pulled from the skin, severing it at the coronet.

THE SUBCUTANEOUS REMOVAL OF A HIND LEG RETAINED UNDER  
THE ABDOMEN.

Reposition should be attempted first when one hind leg lies in the pelvic canal and the other underneath the belly. Should it fail, the hind leg normally presented may be removed,

when the retained leg can usually be adjusted and brought into the pelvic canal.

But when both hind legs are retained and it is impossible to extend the legs or practice extraction in this malposition, removal at the hip joint is indicated.

*Modus operandi.*—To operate successfully, the hind-quarters of the calf must be fixed. For this purpose a rope is placed around the tail as far up as possible, an assistant pulling on it. Now the tail is doubled up and a new loop is placed around these parts over the first loop.

It may also be fixed nicely by passing a short hook with a cord into the rectum, into the oval foramen, by means of which an assistant draws on the hind parts.

The obstetrician passes the sliding bistoury along the tail as far as the coxo-femoral articulation. Since the assistant pulls the pelvis of the calf against the pelvic inlet of the cow, the incision of the hip joint can be made on a comparatively immovable basis.

The incision through the skin is made from the hip joint as far as the postero-external angle of the ischium and sufficiently long to permit introduction of the hand.

The skin is now separated with the hand, or better, with the fingers, upward, forward and downward, until the patella is within reach. After doing it the muscles of the hind leg are cut with the finger knife, not forgetting the biceps femoris and semi-tendinous muscles and the attachment at the cotoyloid cavity. The noose of a rope is now passed under the trochanter around the thigh and back, running the free end of the rope through it. The loop thus formed is placed firmly below the trochanter with the fingers and thumb. An assistant now pulling on the rope dislocates the head of the femur and the leg can be extracted from the skin. The higher up the skin is separated, the easier the extraction of the hind leg. Extraction may also be assisted by separating the skin from the underlying parts, especially the tendo Achilles, while traction is exerted. After the leg has been pulled out of the skin a circular incision is made at the fetlock, and the hind leg

can be removed. The skin flaps are fixed, to be employed when necessary in extraction.

#### THE TURNING OR VERSION OF THE CALF FOLLOWING DIVISION.

*Definition.*—By version is understood the repulsion and rotation of a part of the body primarily presented at the pelvic canal and the introduction to the parturient passage of a part at first distantly located.

In most cases version of the whole calf is impossible. It may be attempted with very small calves when the uterus is not contracted and the greater part of the foetal waters still present. When the calf is wedged, projecting as far as the withers at the vulva, rendering further extraction impossible, the parts already born may be amputated, the skin tied over the trunk and the hind parts repelled and turned so that the hind legs may be guided into the pelvic canal.

*Indications.*—It frequently happens that a calf is extracted as far as the withers or even further beyond the vulva, but that further delivery, in spite of traction, is impossible. This depends on various causes. In most cases the trochanteric diameter of the calf exceeds the height or width of the pelvic inlet. The external angles of the ilia are mostly in the pelvic passage and the trochanters in front of the pelvic inlet. Anybody who has handled a number of such cases knows that the distance between the external angles of the ilia is not the cause of dystokia. An excessive trochanteric diameter is mostly seen in double-enders, in which the hind parts are sometimes only voluminous. In these cases the anterior portion of the body has been extracted with a great deal of trouble, the foetal sacrum catching on the sacrum of the cow.

Saake states that the stifle presentation may produce dystokia. This presentation is only diagnosed when the calf is born as far as the lumbar region. On examination, the stifle is found in front or below the pubis of the cow, the femur perpendicular.

Version succeeding division may be indicated also in some monstrosities.

*Modus operandi.*—After the anterior extremities are born as far as the withers, the skin of the calf's thorax is circumcized 15 cm. from the vulva. The subcutaneous connective tissue is now separated by the hand as far as the vulva, going as far as possible in all directions. After this has been accomplished the vertebral knife is introduced under the skin, severing the spinal column exactly behind the last rib. The abdominal muscles are torn with the hand while an assistant extracts the anterior extremities and thorax. Now the abdominal viscera are removed, the skin secured over the stump, twisting a rope tightly around it. It should be long enough so that the stump may be returned at any time into the pelvic canal.

Next the stump (hind parts) is pushed into the uterus by the hand. This manipulation is greatly assisted by raising the cow behind. After the hind parts have been repelled and rotated, first one hind leg and then the other is searched for and guided into the pelvic canal. Version of parts lying in the uterus is often very difficult, as the pains constantly push the repelled mass against the pelvic inlet, thus rendering impossible the reposition of the hind legs.

Some operators (Wit) fasten a moderately thick and pointed stick loosely in the skin, placing its point into the vertebral canal. After the posterior extremities are repelled, an assistant holds the stick, gently pushing it, until the obstetrician seizes a hind leg; this is followed by immediate removal of the stick. When version is already completed, a hind leg may be subcutaneously removed in the manner previously described; when necessary, one half of the pelvis of the same side, rendering subsequent extraction easy. This method, while frequently employed, has certain disadvantages to be remembered. A calf once decomposing has a tendency to infect the cow when rotated after removing and tieing the skin.

This danger may be prevented when the operation is performed as described under "Complete Embryotomy." When embryotomy has once commenced, it is well to keep out of the uterus as much as possible, avoiding explorations without previously disinfecting the hands and arms.

#### 4.—Complete Embryotomy.

Every practitioner has his own method. One gradually deviates from the original method, modifying it according to one's views and experience.

##### METHOD ACCORDING TO VAN DER LINDEN'S (HOLLAND) DESCRIPTION.

*Presentation of the Calf.*—The head upon the fore legs in the vagina, often tightly wedged by the attendant. The calf is absolutely or relatively too large.

*Modus operandi.*—The vulva is washed with warm water; the fore legs are repelled, flexed at the knees, guided into the uterus and placed under the belly of the calf.

A small hook is inserted into the nose and the head drawn into the vulva as far as the eyes. Now one hook is placed into the eye, an assistant pulling at it. When the legs have been repelled well, the head always projects from the vulva as far as the ears, and may be skinned and removed.

The neck can be easily skinned with the hands. To do this he uses liquid soap and warm water. As a consequence the muscles become limp, so that the connective tissue can be readily severed by the hand. When the neck is thoroughly skinned and moistened with soap suds, the forceps is introduced and the neck removed. As soon as the neck is got rid of we again go under the skin, separating the shoulder of the upper fore leg, which is mainly done by the hand. After separating the shoulder a strong cord is passed around the neck of the scapula and the fore leg pulled out of the skin. The hands are now well washed and lubricated and the other leg adjusted. The obstetrician pulls on the skin of the neck, an assistant on the fore leg which has been guided into the pelvic passage, and in most cases the calf appears as far as the withers.

The fore leg, with the first dorsal vertebra, the anterior ribs and viscera, are removed and the skin separated as far as the forceps can reach. Now six or seven dorsal vertebræ are

severed with the forceps. During this manipulation plenty of soap suds are used, permitting the forceps to advance readily and allowing us to ascertain whether any skin is between the forceps or not; thus the lumbar region is soon reached with the forceps.

Now the skin is separated over the hip joint of the upper hind leg, the muscles are cut with the sharp hook, the femur exarticulated (torn loose with a rope), a cord passed around the femur behind the trochanter, and the leg extracted from the skin. Finally, the loop of a rope is passed through the oval foramen and tightened so as to rest against the anterior border of the opposite ilium. When the pelvis is fixed in this manner no fear need exist that the part will break, one person being sufficient to extract the remains of the calf.

The forceps used by Van der Linden is very strong. The handles are 52 cm. long, the jaws 15 cm. The handles are connected in the middle by a threaded transverse piece so that the jaws can be tightly screwed together.

#### METHOD ACCORDING TO KRUYT'S (HOLLAND) DESCRIPTION.

The presentation of the calf is the same as before.

*Modus operandi.*—When necessary, one or both fore legs are repelled to seize the head. After the head has been fixed by means of one or two little hooks in the orbital cavities, two incisions are made with the ordinary knife, one below the head between the branches of the inferior maxilla, one across the head between the eyes, both as far as the edge of the lip. Both these flaps are skinned to the union of the tongue and larynx, with the lower jaw severed. The branches of the inferior maxilla are severed, and, by twisting, removed with the hand. The skin of the superior maxilla is separated as far as possible with the knife and detached from the cranial parietes with the curved blunt spatula. The ligamentum nuchae and atlo-axoid articulation are cut with a sharp curved spatula. Now a small hook with a cord is fastened in the foramen magnum. By pulling on it the head is brought forward and may be removed with the knife. The neck is left undisturbed and the

upper fore leg is subcutaneously removed as already described. When traction is now exerted on the other fore leg one half of the calf will project at the vulva, followed by amputation of the neck, fore leg and breast. Further manipulations with the knife become possible when now two persons pull on the skin of the calf. Next, the last ribs, belly, dorsal and lumbar region and thigh are skinned by hand. Kruyt uses for this purpose linseed meal paste in large quantities, reducing the labor of separating the skin by hand to a minimum. The ribs are cut with the sharp hook along the vertebral stalk and extracted with the forceps.

After removal of the viscera, only the hind parts and the whole spinal column remain. When the back has been well skinned, the forceps can be passed as far as the pelvis, and the whole vertebral column cut off at once.

The muscles along the lumbar region and the broad pelvic ligament of the upper side are cut with the small sharp hook, and the internal angle of the ilium and the underlying wing of the sacrum is taken off with Hinze's obstetrical saw. After the saw has passed through the bones, the large hook is passed through the same cut to sever any soft tissues still adhering. He incises the muscles around the cotyloid cavity with a small hook, pushing the instrument between the femur and pelvis to cut the soft parts as deeply as possible.

Into this incision is passed the large hook, pulling from within outwards, displacing the head of the femur and rupturing the round ligaments at the same time.

In order to split the ischio-pubic symphysis he employs a sharp heart-shaped spatula. To insert the instrument he locates the proper spot with the nail of the thumb. With a light blow upon the handle the instrument is driven into the cartilage; twisting it to the right and left, the symphysis is separated. The disarticulated half of the pelvis is extracted with a rope or forceps.

Traction is next exerted upon a rope placed around the femur and the balance of the calf delivered.

This method only requires one man for traction. The

execution of this complete embryotomy usually takes about two and one half hours.

Kruyt's small hook is 60 cm. long, its segment being 4 cm. wide.

The forceps is 86 cm. long, the long handles are 68 cm. long and about 3:1.5 cm. wide. The short handles are 18 cm. long and 2.75:1.5 cm. wide. The slightly curved sharp jaws have a length of 8.5 cm. and are at a right angle to the thinnest side of the shortest handles.

#### THE METHOD AT THE VETERINARY SCHOOL AT UTRECHT.

My esteemed predecessor and teacher, Weitzel, followed a method for complete embryotomy on the phantom and in practice, which was modified later in practice but nevertheless must be looked upon as the most rational operation. This method, somewhat modified by me, is as follows:

*Presentation of the calf.*—Head and fore legs drawn firmly into and usually wedged in the pelvic canal.

*Modus operandi.*—The calf is repelled, the head turned laterally against the thorax. The leg to be amputated is drawn as far as possible beyond the vulva and fixed. This fore leg and the other one are removed subcutaneously in the manner already described. The head is adjusted, diverted into the pelvic canal and pulled out of the vulva by means of a loop around the lower jaw or a hook in the internal canthus of the eye.

The head may now be skinned outside the vulva, one incision being made along the nose and skull and one between the branches of the lower jaw. After exarticulating the head at the occipitoatloid articulation it may be removed.

The assistants secure both skin flaps by passing a rope with a loop through each hole for the eye. The skin is separated with the hand, if possible, or small spatula around the neck as far as the first ribs, the trachea is removed and the last cervical and first dorsal vertebrae divided with the vertebral knife. An assistant may then extract the neck by placing a loop around it (fig. 65).

The skin of the neck, which may now be drawn from the vulva, is incised as far as the vulva.

The skin over the ribs and back is separated with the large spatula, the left hand resting upon the skin, always following the movements of the spatula. The skinning may be readily done with the hand. It is of great importance to separate the skin well; unless this is done many difficulties are encountered later.

When the hand can pass below the skin all over the thorax as far as the last rib, the costal cartilages at the sternum are cut from the last rib to the first one—that is, postero-anteriorly—with the sharp probe-pointed hook.

This may also be done with Hinze's saw or the sliding bistoury.

Next the ribs are severed as close as possible to the vertebral column with the sharp hook. The chisel may be used instead.

The incisions with the hook are made from the last rib to the first one. One must be careful not to cut the vertebral attachments of the ribs first and then the sternal, as it is then exceedingly difficult to sever the costal cartilages after they are detached from the vertebral column. The hand may extract the thoracic wall after it is removed in this way (fig. 66).

The other thoracic wall is removed in the same manner. By pulling on the skin flaps the trochanters of the calf come in front of the pelvic inlet and its back into the pelvic canal. The skin is incised as far as the vulva. The intestines are detached with the hand and removed (exenteratio). The skin over the back as far as the sacrum is separated by hand, if necessary with the spatula, always stretching the skin flaps



Fig. 65.



Fig. 66.

outside the vulva while executing the above. At the same time it is necessary that one can reach the posterior border of the broad pelvic ligaments and base of the tail and coxo-femoral articulation. Any connective tissue fibres which might be present are torn with the hand or with the probe-pointed sharp hook. Next the long, sharp and probe-pointed hook is passed under the skin as far as the base of the tail. The probe-pointed portion is pushed downward on the side of the tail until its cutting edge is directed against the pelvic ligament. Pulling the hook now strongly, the broad pelvic ligament and muscles of the croup are severed as far as the

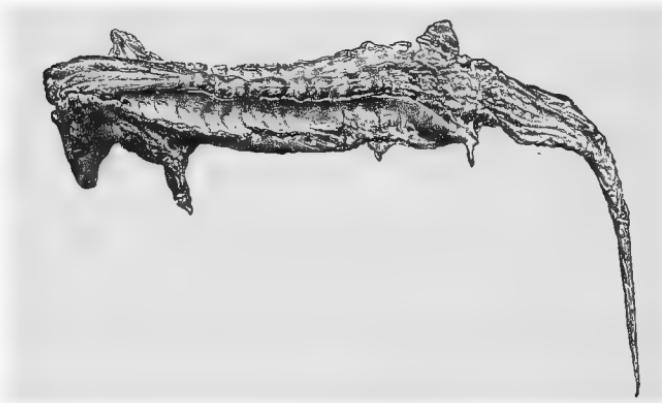


Fig. 67.

sacro-iliac articulation. In order to draw the hook through the joint, it is given a quarter turn, so that the probe-point is directed outwards. A strong pull with the hook splits the joint. The rotation of the hook is necessary considering the direction of the sacral wings.

The instrument is inserted in the same manner to cut through the broad pelvic ligament, muscles of the croup and sacro-iliac articulation.

An assistant may now extract the back, loins, sacrum and tail when a loop is placed well back around the vertebral column. The tail is pulled out of the skin (fig. 67).

Often the balance of the calf may now be extracted by pulling on the skin.

Should this fail, one half of the pelvis is to be removed. For this purpose the symphysis must be split. This may be done with the sliding bistoury, the finger knife or with the sharp hook.

The latter, with the probe-point down, is placed against the ischiatic arch, tearing the union. The symphysis may also be severed with the chisel. It is placed upon the anterior pubic border, exactly in the middle, an assistant driving it with light blows from a wooden mallet. The pelvis may also be divided with Hinze's saw. After separation has been effected one way or the other, the obstetrician draws the loop of a cord along the lower side through the oval foramen and then along the outside of the ilium back; the free end of the rope is put through the loop, pushing it over that portion of the pelvis with the thumb and index finger. Now an assistant may extract that half of the pelvis (fig. 68). The other half of the pelvis may be removed similarly. The head of the femur can now be plainly felt. The muscles around the upper portion of the thigh are severed with the hand and a loop placed below the trochanter. An assistant pulling on the rope, vigorously, can bring it into the parturient passage. As soon as its superior extremity passes into the pelvis the other hind leg enters also and parturition is at an end.



Fig. 68.

#### EMBRYOTOMY IN THE POSTERIOR PRESENTATION WITH BOTH HIND LEGS IN THE PELVIC CANAL.

When complete extraction is impossible in this position, one hind leg is removed subcutaneously, as previously discussed. By pulling now on the other hind leg, extraction of the calf is usually successful.

Should this fail, then embryotomy is continued. First that half of the pelvis is removed from which the leg was taken off. For this purpose the hand or spatula is passed under the skin previously split, skinning the sacrum and loins. The sacro-iliac articulation is cut with the probe-pointed sharp hook or sliding bistoury. Next the symphysis is severed with the chisel or cut with the sharp hook, finger knife or saw.

When now a cord is passed through the oval foramen, this half of the pelvis can be extracted. An assistant drawing on the hind leg pulls the loins of the calf outside the vulva, the withers being in front of the pelvic inlet.

The hind leg is skinned, the skin incision is prolonged on the inside a little beyond the pubis, so that this incision runs into the one of the hind legs previously removed. The skin is separated with the hand and the balance of the pelvis and loins removed. An assistant fixes both skin flaps outside the vulva, so that the hand operates entirely below the skin.

Now the abdominal and thoracic contents are removed with the hand.

After this has been done, one fore leg is removed at the shoulder. This is performed as follows: The skin is separated on one side with the hand, or the long spatula, across the ribs anteriorly beyond the shoulder, tearing with the hand or probe-pointed sharp hook the muscles of the shoulder.

Next the scapula is curved and the fore leg is extracted by one man. Some operators cord the neck of the scapula, or even the humerus. In the latter instance it may happen that when the scapular muscles are not completely severed, the humerus breaks, or that the scapula does not follow in the direction of the pelvic canal, but becomes vertical, interfering with the extraction of the leg.

After the removal of the fore leg, the skin, still adhering to the fetlock, is circumcised. The other fore leg is removed in the same way. The ribs are cut with the sharp hook or finger knife along the sternum from the first to the last rib, also the union of the ribs with the spinal column, finally removing the thoracic wall.

The other thoracic wall is detached similarly, followed by extraction of the balance of the calf by the flaps of skin previously secured. Harms's method of incising the skin before removing a fore leg deviates somewhat from the manner described on page 271.

He circumcised about three-fourths of the skin of the fore arm, a little above the carpus. After separating the skin a little above the wound with the thumb, the spatula is introduced to sever the connective tissues and all the muscles excepting the *M. cuccularis*. Next he cuts the remaining skin of the first incision, also the skin along the whole limb. After that three men exert traction.

Franck-Göring, after fixing the leg, split the skin on the internal surface of the limb and the superficial fascia from the sternum to the fetlock. They use the finger knife or chisel with concave cutting edge and a probe-point on each side. The balance of the skin is separated with the hand or spatula. After the skin is completely severed at the shoulder, the pectoral muscles are cut, the skin at the fetlock is circumcised and the leg extracted.

## AUXILLIARIES IN THE STUDY OF MECHANICAL OBSTETRICS.

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The young veterinarian in the beginning of his practice meets with many difficulties. Nobody expects and demands that he should be an experienced practitioner. He certainly is not yet an expert in practical obstetrics, and here the adage "practice makes perfect" holds true. Of course the basis for it is laid at college, so he may not be embarrassed when called to an obstetrical case. Instruction only cannot school him to such an extent that he directs a case of dystokia with as much dexterity and ease as a common surgical operation, for instance, tracheotomy. Nevertheless, the college may assist him a great deal in this respect, of decided value later; as by the exercises on the phantom.

### THE OBSTETRICAL PHANTOM.

*Pelviarium* is an imitation of the uterus, pelvis and vagina. It serves to recognize and adjust abnormal presentation as in embryotomy.

*The phantom of repositions* (fig. 69) consists of the skeleton of a cow or mare in the standing posture. For the sake of greater solidity, iron rods are passed through the vertebral column and underneath the vertebrae, resting anteriorly upon two rods standing obliquely and posteriorly upon an iron tripod. Heavy band iron is placed along the linea innominata and symphysis, the same along the costal cartilages. The abdominal wall is made of leather; the latter can be removed.

The uterus is made of calf's leather, tapered to fit the vagina. On the side of the uterus is a flap through which the calf is introduced. This flap can be closed.

The teacher, or whoever stands on the side of this flap, can place the calf into any position he sees fit, to be diagnosed and adjusted by the student.

This phantom is valuable to students who wish to become dexterous in cording, adjusting and applying hooks. It may also be used in demonstrations; for instance, the diagnosis of torsio uteri.



Fig. 69.—Phantom for the Study of Malpositions.

#### THE PHANTOM OF EMBRYOTOMY.

A practical and simple phantom is shown in fig. 70. It consists of a strong board with a round opening in front. The inner border of this opening is padded with leather. The part resting on the table has two iron pins fitting into two holes in the table. The board is held in place by two clamps.

A dead calf is placed upon the table; the student, standing in front of the board, passes the hand through the opening, pulls



Fig. 70.—Phantom for the Study of Embryotomy.

a leg or head through it and performs embryotomy as already described.

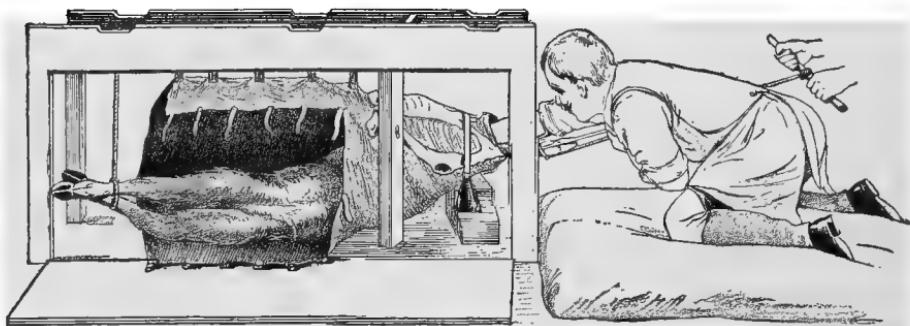


Fig. 71.—Phantom for the Study of Embryotomy.

A student purchasing this cheap phantom may become an

expert in embryotomy. It has the advantage that all motions of the student are visible and may be corrected.

Already in 1851 S. Witt, instructor in obstetrics, gave a course in embryotomy at the Utrecht school. For this purpose he had made a phantom (fig. 71), consisting of a bovine pelvis with the part of the vertebral canal, resting and fastened to a wooden frame. The position of the pelvis padded with leather corresponds to the one of a cow in the recumbent position.

Uterus and vagina are represented by a sac of leather, with a flap on the side to introduce a dead calf.

In the phantoms, newly born calves bled to death may be used. When the calves become several days old they may still be used, but the subcutaneous tissue has then become rather firm.

## DISEASES DURING AND FOLLOWING THE ACT OF BIRTH.

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### 1.—Sprains, Luxations and Fractures Following Parturition.

When violent traction is practiced during dystokia, exposing the long pelvic canal to excessive pressure, many disturbances may arise. Sprains, mostly accompanied with partial rupture, usually concern the ligamentous apparatus of the sacro-iliac articulation. In this case there need not necessarily be a disturbed relationship between the sacrum and the external angle of the ilium, but the union of the pelvis with the trunk may have become less solid, leading to disturbances in position and walking of the animal.

*Causes.*—This disease often follows when the interior half of the calf's body is delivered by severe traction while the trochanteric diameter of the calf lies in front of the pelvic inlet. This traction spreads the greatest pelvic diameter, producing a stretching or even luxation of this rather immovable joint, since the internal angles of the ilia come further apart. This sprain may also follow strong traction on the calf with cow in the dorsal position. In lymphatic animals there is the possibility that when the abdominal pressure is active, already a limited traction may cause rupture, since the movement of this joint in such animals amounts to several millimeters.

When upward instead of downward traction is practiced on the calf, sprains are more readily caused.

*Symptoms.*—The cow can rise only with difficulty. She sways to and fro, and when the hind legs are close together she easily loses her equilibrium and falls down; but when the hind legs have their normal position the equilibrium is

pretty well retained. When the cow attempts to plant a hind leg, it makes an impression as if the extensor muscles of the leg are paralyzed. At the moment the function of the supporting leg sets in,\* the fetlock knuckles over so that its anterior surface often touches the ground.

When we place the foot against the anterior surface of the joint, knuckling can be prevented and the cow is able to bear weight on that leg.

*Course and Prognosis.*—Observations indicate that a simple sprain, often only unilateral, with limited rupture of the ligamentous apparatus, is usually followed by recovery. The prognosis becomes more favorable the better the animal can rise and stand.

Absence of luxation between the sacrum and ilium allows us to predict recovery in two or three weeks.

Nevertheless, many animals, which stood quietly in the stable and apparently recovered, showed a swaying walk as soon as they go to pasture, but improvement usually sets in after a few weeks of rest.

*Treatment.*—When professional advice is requested immediately after parturition, the animal is to be placed on a horizontal floor and not on a place lower behind than in front, or where it may possibly slide into a gutter. The bedding must be of a nature to prevent the legs from getting entangled.

Further treatment is very simple. The animal is to be fed less voluminously but more intensively, and any eventual complications are to be prevented. Care must be taken that such an animal does not lie on its side, but rests upon the knees and sternum. The former, especially when lying on the left side, causes tympanitis. It happens that tympanitis disappears immediately, changing the general appearance of the animal, when the cow is placed on the knees and sternum. Many veterinarians order embrocations of ammonia or oil of terebinth, spirits of camphor, etc., in the sacral and lumbar regions. These applications are useless and have only then

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\* See my "Clinical Diagnosis of Lameness."—W. E. A. W.

value when they induce the owner to execute the other and more rational orders. For that purpose it is well enough to prescribe them.

It is advisable to rub the legs several times daily with a straw wisp to stimulate circulation.

The udder must also be cared for. The cow must be milked cautiously and patiently several times daily. The bedding must be kept very clean, as a mastitis the result of infection often sets in, as she is milked while in the recumbent position.

*Luxation* following parturition may involve the sacro-iliac articulation and coxo-femoral articulation.

#### LUXATION OF THE SACRO-ILIAC ARTICULATION.

The connection between the vertebral column and the posterior extremities is mainly established by this joint. The wings of the sacrum and the external angles of the ilia are in contact with each other to quite some extent.

This joint can expand most during the act of parturition, since the postero external angles have an upward direction (oscillating movement of the pelvis). We noticed previously that Berdez first drew attention to the fact, that the relaxation of the broad pelvic ligament mainly depends on the elevation of the posterior part of the pelvis in the preliminary stage. This position is produced by the diminished traction exerted upon the pubis by the rectus abdominis muscle.

*Causes.*—Luxation usually follows as the result of too frequent upward traction during parturition, but also when the cow is raised with the tail after having given birth. According to Stockfleth, complete luxation follows muscular efforts.

*Symptoms.*—The relation of the sacrum to the ilia has changed, the vertebral column has descended, so that the internal angles of the ilia project. The descended promontorium is readily located on rectal examination. As a result of the rupture of the ligamentous apparatus a hemorrhage occurred; even an extensive hematoma may be found there.

At first the general health is somewhat disturbed, dis-

appearing after a few days. Such animals usually cannot rise. When assisted they knuckle over at the fetlocks of the hind legs, remaining in the standing posture but a short time. The subsequent drawing shows a cow suffering with a limited luxation of the sacro-iliac articulation, the result of excessive traction during parturition (fig. 72).

*Prognosis and Course.*—When the sacrum is but little displaced, it is possible that the cow gets up in eight to ten days and improves gradually but very slowly.

At the same time it is impossible to ascertain how much union there is still between the sacrum and ilia; in fact, any

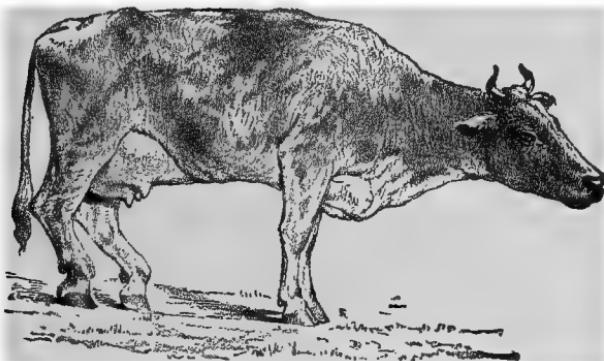


Fig. 72.—Luxation of the Sacro-iliac Articulation.

attempt to rise may increase the rupture. The prognosis therefore must always be doubtful.

There are cases where the dislocation amounts only to a few centimeters and where such a firm connective tissue union is established in two months that the cow can walk about nicely. From the standpoint of the breeder, it must be remembered that the height of the pelvic inlet is lessened in such a case.

Stockfleth had a picture made of a sacro-iliac luxation 43 days old which occurred the day after calving and where the displaced wings of the sacrum had become united with the posterior iliac angles by strong connective tissue.

*Treatment.*—Absolute rest and a horizontal position are the main factors. When a luxation is surmised the animal must not be forced to rise, but left in the recumbent position. She should rest upon a horizontal bedding, upon the sternum, flexed knees and hocks. To prevent the animal from lying flat on its side, it should be banked up by straw. As regards medication, the same holds good as remarked when discussing sprains and partial rupture of the ligamentous apparatus of this joint.

Luxation with partial rupture of the ligaments, as well as complete luxation of this joint, are often the cause that the animal remains down after parturition.

Violent traction is not necessarily always the cause of it. Luxation may also follow aggravated contraction of the abdominal parietes, disturbing on the one hand the harmony between the rectus abdominis and psoas parvus muscles, and on the other the extensor muscles of the back.

#### LUXATION OF THE COXO-FEMORAL ARTICULATION.

This luxation sometimes follows dystokia indirectly. It may be caused when the hind leg lies under the body and the animal falling down while trying to rise; further, when she falls down while the hind leg slips outward at the same time, thus forcibly abducting the whole limb.

Stockfleth saw a backward and inward luxation in a cow which had been raised with ropes fastened to the hocks, hanging mainly by one leg. Should an animal remain down after parturition, this luxation must be remembered.

#### FRACTURES.

Pelvic fractures may follow dystokia when violent traction is practiced, the cow pulled from the bedding and lying lower with the hind quarters, when she falls down after having been raised with a great deal of trouble by pulling excessively on the tail to accomplish this object. The most common fractures involve one wing of the sacrum, and shaft of the ilium,

obturator foramen and the ischium posterior to the cotyloid cavity.

In all these fractures the cow cannot rise, or only with difficulty. With regard to their diagnosis, I refer to works on surgery.

## 2.—Injuries of the Uterus, Vagina and Vulva.

Various injuries of the uterus may occur during birth. The mucosa may only be involved, but also the muscularis and serosa. It is termed a penetrating wound, when all three layers are included. Eventration may or may not be present. Abdominal viscera may possibly pass through the wound into the uterine cavity, usually the colon or the omentum. Uterine injuries may be divided into spontaneous ruptures, small wounds in the pregnant cornu and in the cervix.

Spontaneous ruptures are those which take place at the end of the period of gestation or during the act of parturition, without being caused by any interference from without.

*Causes:* Torsio uteri (Albrecht). On account of the circulatory disturbances following torsio uteri, this organ is predisposed to rupture, which takes place readily on the slightest cause; but external injuries also may give rise to it, as seen in the case described by Albrecht, where abdominal hernia and a uterine rupture 30 cm. long followed the blow from a horn. Ruptures in the posterior segment of the uterus usually occur during the act of parturition.

Tapken is of the opinion that, since in all probability the contractions of the bovine uterus—same as that of man—render it longer and more narrow, the muscular elements accumulate opposite to the cervical canal, this causing a stretching of the posterior uterine segment and possibly rupture. This view seems to be correct, since experience teaches that in certain positions of the foetus energetic uterine contractions predispose to rupture. Very often we observe in spontaneous rupture of the uterus a posterior presentation with the hind legs under the abdomen (Tapken, Strebler, Albrecht). I myself have seen

two cases of such a posterior presentation in practice, where a spontaneous rupture followed violent uterine contractions during exploration.

Tapken reports a case of posterior presentation of a calf with the hind leg retained under the body. While adjusting the parts the cow suddenly made a violent move, followed by a considerable rent in the uterus.

Spontaneous ruptures usually take place in the floor of the uterus within 10 cm. from the cervix, and always involve all three layers, showing a length of 20 to 30 cm. and more. They may be so large that the calf passes through them, lying free in the abdominal cavity.

The *diagnosis* is not difficult. On exploration, the calf is found to have descended and the large intestines are usually in the uterine cavity. Close examination reveals the direction and extent of the rupture.

*Course, prognosis and treatment.*—The course is acute. A violent peritonitis or internal hemorrhage usually causes death within a few hours. Those ruptures of the uterus which take place while the cervix is closed form an exception. It happens that obliteration of the os uteri is followed by rupture of the uterus and no air entering. Rupture the result of torsio uteri may also occur without entrance of air. Here the course is different. Such animals show the symptoms of an internal hemorrhage or subacute peritonitis, causing a fatal termination in due time. Since treatment is out of the question, the animal is to be slaughtered.

*Small injuries in the pregnant horn* are often produced by rough manipulations while correcting a malposition, or by the slipping of the hook. These small injuries do not exceed 10 cm., and differ materially from the spontaneous ruptures. Among others, they may follow reposition of retained hind legs in a posterior presentation, when the fetlock is corded and pulled at, without repellng the foetus or resting the hand against it. In this rough method the fetlock of the calf rotates under the pubis, exerting such pressure upon the floor of the uterus that a rupture may easily take place. Rupture may

also follow when the head of the calf is pushed back into the uterus to gain room, and forcibly extracting the fore leg from the skin (Tapken).

The application of the obstetrical crutch may also lead to rupture of the uterus, when an assistant repels the calf and the instrument glides off. This instrument anyway may be readily dispensed with. Many veterinarians are of the opinion that rupture of the uterus, no matter from what cause, is especially frequent in fat cows. This depends probably on fatty infiltration of the tissues, thus lessening their powers of resistance.

*Symptoms.*—Non-penetrating wounds frequently cause violent hemorrhages; at the same time they may be overlooked and become the source of a general infection.

A phenomenon most conspicuous in penetrating uterine wounds is straining, pretty soon followed by symptoms of peritonitis, due to the septic uterine secretion which entered the abdominal cavity.

The temperature is accordingly higher, usually 39.5 to 40 degrees C.; but it frequently happens that there is no rise in temperature and only an increase in the pulse rate (above 100). The latter is an ominous phenomenon. The animal feeds but little, rumination is suspended and the lacteal secretion greatly diminishes.

In fatal cases the belly is tense, and colicky symptoms appear. Small wounds in the roof of the uterus may heal, and do not give rise to marked symptoms.

*Course and Prognosis.*—The course is favorably influenced by a rapid contraction of the uterus after birth. As a result of this, a uterine wound is decreased two-thirds already a few hours after parturition, which fact explains the favorable termination of many cases of Cæsarean sections where the uterus was sutured insufficiently.

The prognosis in non-penetrating wounds is much more favorable than in penetrating ones, although the former may lead to a fatal termination when infected.

Wounds in the region opposite the rectum are not soiled by the secretion of the uterus, and therefore allow us to give a

more favorable prognosis than those in the floor of the uterus.

The danger of infection is always great when there is retention of the foetal membranes and a uterine wound. It is always well to give a doubtful prognosis even when the wound is but little. Penetrating wounds always demand an unfavorable prognosis.

*Treatment.*—When the afterbirth is not yet expelled, it must be removed immediately to encourage early contraction of the uterus.

Non-penetrating wounds, when within reach of the hand, may be slightly cauterized. Nevertheless the main thing is to encourage involution. For this purpose a subcutaneous injection of 5 to 8 g. of extractum secalis cornuti in 5 g. of glycerine and 5 g. of water in one dose is advisable. In cases of violent hemorrhage the uterine cavity may be tamponed with jute saturated with a boracic acid solution. The tampon is retained by suturing the vulva and removal in eighteen to twenty-four hours. The uterine contractions expel the lochiæ, thus diminishing the danger of infection.

Irrigations of the uterus must not be practiced in superficial and penetrating wounds. Even in wounds of the first category irrigation may be dangerous, as the extent of the lesion is difficult to ascertain, and in consequence of high pressure the fluid may pass into the abdominal cavity. The reflex activity of the abdominal parietes may be counteracted by clysters of choral hydrate.

Injuries of the cervix are most common in practice, especially at the so-called *portio vaginalis*, mainly in primiparae.

*Causes.*—The cervix uteri is easily wounded when the os is partially dilated and traction is exerted on the calf. Mostly the superior wall is injured, which is dilated until it finally tears. Rough attempts at reposition and the slipping of a hook may also cause such wounds.

*Symptoms.*—Injuries of the upper wall do not give rise to special symptoms; only in deep wounds, extending as far as

the excavation, eventration may follow straining. All penetrating wounds, even without eventration, lead to peritonitis.

Injuries of the inferior wall are followed by serious hemorrhage; a great many cases of metrorrhagia depend on it. During the examination the squirting of the arteries can often be felt. The mucosa may be torn from the muscularis to quite some extent. This is frequently the case when the anterior or posterior half of the body is wedged in the pelvic canal, and the calf turned forcibly around its long axis.

*Course and Prognosis.*—Injuries of the upper wall of the cervix not extending to the excavation usually heal. There is great danger of infection in emphysematous calves and in these where the afterbirth is decomposing. Under such circumstances the prognosis is less favorable.

Wounds which extend into the excavatio vesico-uterina, either with or without eventration, always force us to give an unfavorable prognosis.

*Treatment.*—The essential point lies in the prevention of infection. For this purpose the secundines are to be removed immediately after birth, and contraction of the uterus is to be effected by a subcutaneous injection of extractum secalis.

When in serious hemorrhage the artery can be grasped with the fingers it must be twisted or ligated. This is sometimes possible.

Should it be possible, the os uteri is tamponed with jute or cotton previously soaked in a boracic acid solution. Klinkenberg (Holland) used in such a case six towels and one pound of jute; the vulva was sutured to retain the tampon. The tampon is removed in twenty-four hours.

As a rule, the uterus has between times contracted sufficiently; when necessary, the injection of ergot of rye may be repeated.

In small injuries of the cervix, local and antiseptic treatment suffices.

It is evident that irrigations of the uterus must be omitted in penetrating wounds of the uterus. When a piece of the omentum has entered through the cervical wound into the

parturient passage it is drawn in further and severed. This is followed by agglutination and recovery, provided the uterine secretion is aseptic.

Many veterinarians successfully order cold applications to the loins to encourage contractions of the uterus.

Franck insists that in *post partum paralysis* the bruised uterus (cervix uteri) may reflexly produce paralysis of the posterior extremities. He states that this reflexory paralysis in one or both limbs, originating in the uterus, is also seen in man, and adds: "They frequently disappear on thorough cauterization of the offending portion of the uterus."

Schurink also describes a case in which post partum paralysis was due to injury of the uterus.

#### INJURIES OF THE VAGINA.

Most injuries of the vagina take place during parturition. They may occur when extraction is attempted during violent pains with the calf in an abnormal position. With one fore leg flexed at the carpus and retained, and the other leg and head lying normally, limited traction suffices to tear the vaginal wall, already tense. Rough manipulations during reposition may cause injuries.

A common cause of vaginal wounds is the slipping of the hooks or injury by sharp pieces of bone, the result of embryotomy.

*Symptoms.*—In many cases the wound is only detected on vaginal exploration. Penetrating wounds are characterized by a more general disturbance, wanting appetite, straining and symptoms of peritonitis.

In eventration a piece of the omentum is mostly found in the vagina, especially when the wounds are in the lower wall and near the external os uteri. In those cases the owner calls the veterinarian because he sees a piece of fat, often 5 cm. wide, protruding from the vulva.

Large penetrating wounds may be followed by a prolapse of the intestines. Eventration increases on account of the persistent straining.

Wounds in front of the opening of the urethra and extending into the excavatio may cause dislocation (prolapsus) of the bladder, which protrudes and lies in the vagina. The neck of the bladder is stretched and micturition rendered difficult. As a consequence the urine accumulates, this dislocation shortly leading to rupture of the bladder.

*Wounds in the upper wall* may involve the rectum, and faeces drop through the opening into the vagina. These wounds are usually close to the upper commissure of the vulva.

When the vaginal wound becomes infected, either by direct inoculation, as is the case in emphysematous foetuses, or infection takes place later through decomposing uterine secretion, other phenomena offer themselves.

Under those circumstances a diffuse swelling of the labiæ is first noticed. It usually sets in at the third or fourth day and is not only limited to the vulva but also to the submucosa of the vestibule and vagina. The vagina is swollen so that the hand is passed in with difficulty. The examination is very painful to the animal; a great increase in temperature is plainly felt. A dark-colored, stinking fluid flows, as a result of the swelling, from the vulva. Micturition is difficult, the urine being discharged frequently and in small quantities. The swelling about the rectum may mechanically interfere with defæcation.

At first the general health is but little disturbed. As infection progresses, high temperature, increase in respiration and pulse rate set in, appetite and rumination diminish, the lacteal secretion is limited.

*Course and Prognosis.*—The course of superficial wounds of the uterus is favorable, provided involution of the uterus is normal. At the same time vaginal wounds occasionally terminate favorably in spite of a decomposing afterbirth, due to the fact that the wound was filled with granulation tissue—an excellent protection—at the time infection might have taken place.

It is further observed that putrefactive bacteria need not necessarily always infect a wound; nevertheless, they prepare the medium for streptococci. This explains why vaginal

wounds—even small ones—are so dangerous when an emphysematous foetus or decomposing secundines are present; simply because the protecting granulation tissue is wanting.

Penetrating vaginal wounds in the upper wall, 13 cm. or more away from the superior commissure, or when in the lower wall in front of the urethral opening, are judged less favorably. In either case they involve the peritoneum. Experience teaches that wounds without eventration, and even wounds where a portion of the mesentery lies in the vagina, may heal with proper treatment, but the prognosis must be guarded on account of an eventual infection.

*Treatment.*—Of primary importance is the prevention of infection, and further to hasten the process of involution. The secundines must be removed when still in the uterus. Smaller wounds are treated locally and antiseptically. Whenever possible, penetrating wounds of the upper wall are sutured. In eventration of the mesentery the same treatment is pursued as suggested under wounds of the cervix.

When a prolapsus vesicæ is present and the distended bladder lies in the vagina, it must be punctured with a trocar and emptied, followed by its reposition and stitching of the vaginal wound. Wounds which extend into the rectum may cause a recto-vaginal fistula. With regard to it, I refer to special surgery. In case a foetus has been wedged in the vagina for some time, the walls of this canal may be exposed to such pressure that the circulation, and in consequence of it nutrition, is disturbed.

This is observed in cases where the anterior extremities of the calf are born and where an attempt was made to extract the hind parts forcibly. When parturition is completed by partial embryotomy, more or less necrosis of the mucous membrane of the vagina, the result of the pressure, manifests itself within a few days. We observe gangrene, decubitus of the vaginal wall. A phenomenon preceding the expulsion of the necrotic mucosa, is the swelling of the vagina and vulva, interfering with micturition, urine being evacuated frequently and in small amounts.

The swelling diminishes in four to five days, a stinking fluid flowing from the vulva. Examination reveals that the leather-like mucous membrane has become detached here and there, granulation tissue being visible underneath the crusts. In about ten days the necrotic mucosa is expelled and the internal wall of the vagina shows a granulating surface covered with a small amount of creamy pus. The membranes are to be cut off or removed with the fingers, and warm antiseptic solutions should be injected, such as 2 per cent. carbolic acid or creolin solutions, followed later by a 2 per cent. alum solution.

In consequence of the retraction of the granulation tissue, the lumen of the vagina is decreased and the elasticity of the vaginal walls lessened, so that such a spot often forms an obstacle to future birth.

#### INJURIES OF THE VULVA.

In dystokia, excoriations of the vulva are frequently met with. They are the result of the tension to which the labiæ are exposed during passage of the calf. The subcutis, the muscular layer and the mucous membrane are more elastic than the skin.

A vulva which is too narrow is often ruptured, the superior commissure being mainly involved in primiparæ. Wounds on the lateral surfaces of the labia are caused by rough manipulation, by instruments and projecting bones after embryotomy.

Although the wounds of the vulva are less important than those of the vagina and uterus, the danger of infection is nevertheless present. During the puerperal state quantities of pathogenic low organism and their media are discharged, thus offering ample opportunity for septic infection. This danger is partly lessened after the wound once granulates.

The superior commissure may rupture to such an extent that the perineum is torn in a vertical direction; in such a case the faeces drop into the vestibule—a serious complication unless quickly attended to.

*Treatment.*—Any injury of the vulva, no matter how insignificant, demands attention. The labiæ are cleansed with

soap and warm water and the small wounds slightly cauterized. For this purpose a 5 per cent. chloride of zinc or 5 per cent. carbolic acid solution is employed. It is also advisable to paint the wound with tincture of iodine. Wounds which extend through the skin or mucous membrane into the muscular layer, are cleansed, freshened and stitched. The suture is covered with iodoform collodion or traumaticine.

Injuries through the perineum into the rectum are cleansed and made into fresh wounds by removing all necrotic tissue and scarifying the edges of the wound. Next, the upper wall of the vestibule is sutured with strong silk, and then the outer skin. It sometimes happens in protracted labor, when the labiæ are rendered tense for a long time, that the vulva swells enormously. This may depend on a hemorrhage underneath the skin, in the elastic tissue or muscular layer (hæmatoma). Circulatory disturbance, especially venous stasis, may also produce it.

The hæmatoma, usually unilateral, may be underneath the skin or mucosa. The coagulated blood is removed by an incision and the cavity irrigated with an antiseptic solution.

Swelling of the vulva, due to venous stasis, involves both labiæ. It increases when the animal remains down (hypostatic oedema). Gangrene, usually confining itself to a small part of the mucous membrane, or skin, may also follow circulatory disturbances. Necrosis of a triangular piece is sometimes observed, its basis lying in the mucous surface of a labia and the apex in the muscular layer. This circumscribed necrosis is due to thrombosis, interfering with the nutrition of that tissue.

The treatment of the oedematous vulva consists in encouraging circulation by keeping the animal standing. It is remarkable how soon large swellings of the vulva will disappear in this way. In a few hours already the skin of the vulva becomes wrinkled, due to an equalized circulation and decrease of the swelling. When the cow cannot stand, the hind quarters must be elevated; the latter ought to be done anyway. Some veterinarians employ stimulating remedies, as applica-

tions of spirits of camphor, tincture of arnica, etc. It is not advisable to chill the vulva; in fact, washing it with warm milk is useful.

### 3.—Prolapsus of the Uterus. *Inversio et Prolapsus Uteri.*

*Definition.*—By prolapsus of the uterus is understood that change in the position of the gravid uterus where the impregnated horn is inverted and eventually appears without.

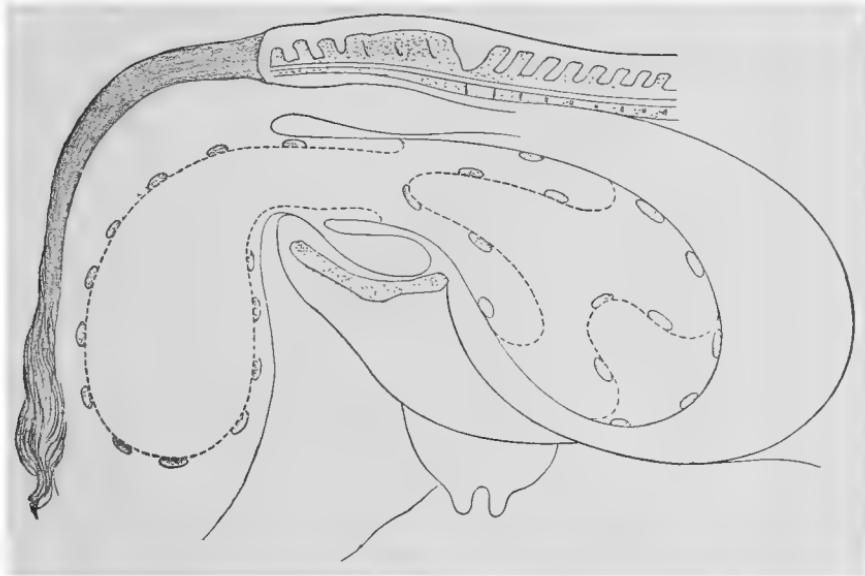


Fig. 73.—Prolapsus Uteri in various stages.

As long as the inverted part does not project from the vulva, an *inversio uteri* exists. When the inversion progresses and pushes the uterus out of the vulva, it is termed *prolapsus uteri*, or, better, *inversio et prolapsus uteri*. In the latter the uterus may protrude partly or entirely from the vulva.

The above schematic sketch shows the inversion in various stages (fig. 73). In many instances the empty horn is not inverted. In those cases one finds a slit-like opening on

the lateral wall of the gravid and prolapsed horn, leading into the empty cornu.

Prolapsus uteri is frequently seen in the cow, especially in lymphatic, excessively-fed and old animals, which have calved repeatedly; it is comparatively rare in properly fed young animals.

It follows difficult and normal labor, also the partus prematurus, and may occur any time after the calf is born until the cervix uteri closes. As long as the cervix uteri is sufficiently dilated to allow the hand to pass, inversion and prolapsus are still possible.

*Causes.*—They may be divided into two main groups: predisposing and direct causes.

#### PREDISPOSING CAUSES.

(a) *Relaxation of the mesometrium.* One must not think that the broad ligaments are stretched to such an extent that they participate in the whole displacement of the inverted horn. In a complete prolapsus only one half of their normal length is involved, as they are closely attached to the body of the uterus and do not carry but a small portion of the pregnant horn. Therefore one half of the length of the inverted horn may project at the vulva before the broad ligaments are stretched at all.

(b) *Sloping position.* This induces a displacement of the uterus toward the posterior portion of the abdominal cavity. It also causes violent after-pains, in which the abdominal muscles are actively concerned, thus rendering it possible that the floor of the impregnated horn becomes inverted by the pressure of the abdominal viscera. Into the space thus created more intestines crowd, increasing inversion and prolapsus.

(c) *Insufficient uterine contractions.* As a result of this the cervix uteri remains open after parturition, permitting easy passage of the inverted horn. The surface of the dilated horn is besides much greater, so that the probability of an inversion under such circumstances is greater than in a contracted state of the uterus.

Violent straining or a sloping position behind, together with insufficient contraction of the uterus, are especially favorable to inversion (Franck). Strong contraction of the uterus does not encourage inversion, but prevents it, on account of the closure of the cervix uteri. The malposition depends on the straining and displacement of the abdominal viscera toward the pelvic cavity, leading to inversion of the uterus.

(d) *Relaxation of the broad pelvic ligaments.* In cows which have calved repeatedly the broad pelvic ligaments are often relaxed. In such animals, when lying low behind, prolapsus vagina occasionally is observed. In consequence of this the uterus may be drawn into the pelvic cavity after parturition becomes inverted, terminating in an inversion, when straining is severe.

#### DIRECT CAUSES.

(a) *Aspiration during parturition* (Franck). When severe traction is exerted upon a large foetus, so that it is delivered with efforts inch by inch, it may happen that after the hind parts of the calf have passed the pelvic outlet, the cotyledons of the gravid horn present themselves already in the vulva. Active straining is then sufficient to expel the inverted uterus. Irrespective of aspiration, the prolapsus may in such a case be due to the pulling on the after-birth when a good deal of it is wedged in between the calf and pelvic wall. Aspiration may take place (as Franck correctly states) when the entire or nearly all of the foetal waters were discharged previous to traction. As a consequence, the uterus clasps the calf firmly and during its passage inversion, and later prolapsus, is apt to follow.

(b) *The weight of the secundines.* This is certainly the most direct cause. After parturition the secundines are still connected with numerous cotyledons, only a portion hanging from the vulva. The more foetal placentæ become detached, the larger the piece hanging from the vulva and the greater the traction exerted upon the cotyledons which are still united. When the adhering placentæ lie in that portion of the horn turned toward the abdominal cavity, it may be readily inverted

by the weight of the foetal membranes (Harms). Even a slight inversion gives rise to straining, pushing the intestines against the inverted uterus, thus increasing the *inversio uteri*.

As a rule the *placentæ* separate in time and the pending danger is over; but when the foetal and maternal *placentæ* are firmly united, inversion is very likely to occur.

When the afterbirth is expelled and the uterus contracted, so that the cervix is closed, there is no longer any danger of prolapsus. At the same time, I have seen, that two hours after the *secundines* were expelled and everything had taken a normal course, inversion and prolapsus occurred. It was due to a sloping position and insufficient uterine contractions, in consequence of which the cervix uteri remained wide open.

(a) *Symptoms of inversio uteri without prolapsus.* The fecundated horn is inverted and the inverted part pushed into the cervix or vagina. The owner usually furnishes the following history: "The cow calved a few hours ago (or sometimes on one of the preceding days). After a while she began to strain more and more in short intervals. The general health is disturbed; the cow does not eat or chew the cud, and is only induced with difficulty to rise."

*Examination.*—On vaginal exploration the hand feels a round mass in the vagina or cervix. Close examination reveals it to be the uterine mucosa with the cotyledons. It may happen that the inverted uterus is wedged in the vagina (Neidhardt), or the cotyledons may be visible between the labiæ.

During the examination the cow strains violently, interfering with the passage of the hand. This invagination of the uterus, often but limited, causes continuous straining. The condition can only be diagnosed by an internal examination, thus preventing an otherwise fatal termination.

(b) *Symptoms of inversio et prolapsus uteri.* Its diagnosis is easy. One notices behind the cow a pear-shaped tumor hanging out of the vulva, becoming gradually wider, finally having the shape of a bean. In the standing cow it reaches as far as the hocks.

The surface formed by the mucosa shows the cotyledons, which are sometimes still connected with the foetal placenta of the chorion, so that the foetal membranes surround the inverted uterus like a sac. In a complete prolapsus the vagina is always inverted, showing about four inches from the vulva, the palma plicata appearing like a wide band all around the inverted part, being narrowest right here (fig 74).

After removal of the secundines the mucous membrane looks dark red, due to the influence of the air and venous stasis. The older the inversion the greater the changes which



Fig. 74.—Prolapsus Uteri.

take place. After a few hours the mucosa is of a bluish-red color, showing dark spots here and there; these must not be looked upon as due to gangrene. They depend partly upon the disturbed return flow of the blood and partly on submucous hemorrhages (haematomata). When the prolapsus is permitted to hang any longer, oedema of the submucosa and muscularis and finally gangrene set in.

Prolapsus following abortion is not as extensive as the one following ordinary labor. The dimensions of the prolapsus correspond with the size of the uterus at the time of pregnancy.

When inversion and prolapsus occur some days after birth, the dimensions are also less than when immediately following parturition. I know of a case where prolapsus uteri took place six days after birth, the afterbirth having been retained. The prolapsed portion was about one-half the size of the complete prolapsus previously described.

In those cases observed by me the prolapsus only involved the gravid and inverted horn. Inversion of the empty horn is mentioned by some professional men.

The general health is materially disturbed. The cow strains constantly, both when down and standing, defæcates frequently, soiling the uterus. When considerable blood has been lost, the animal usually remains in the recumbent position and the mucous membrane of the mouth is pale.

*Prognosis.*—This depends on many circumstances, and the following points are to be considered:

1. How long does the prolapsus exist and what changes have taken place? When the prolapsus is only of recent date and the secundines still attached to the cotyledons and no injuries are present, the prognosis is favorable, but becomes less favorable when oedema of the uterus is extensive.

2. Should the examination reveal superficial wounds, the prognosis is doubtful, as infection may take place. Perforating wounds demand an unfavorable prognosis, especially when due to treads of a neighboring cow. Veterinary literature mentions cases where uterine injuries in a prolapsus healed after reposition. A favorable factor is the contraction of the organ after it is returned to the abdominal cavity; by it large wounds become smaller and small wounds close entirely.

3. What treatment has the prolapsus received so far? The veterinarian is not always the first one to lend a helping hand. Before his arrival, the owner or an empiric have often exhausted their skill, and not always in a cautious manner. Therefore the whole prolapsus must be carefully searched for any wound and must be examined whether any cotyledons are torn off or perforating wounds exist. The prognosis depends on the results of the examination.

*Treatment.*—Reposition and retention of the prolapsus are the points. Before reposition is attempted, certain preparations must be made, which never should be omitted, as the success of the operation depends entirely on them.

1. *Preparation.* When the veterinarian is called to attend a cow with prolapsus uteri, he usually finds on entering the stable that the cow lies on her side, the hind parts often lower, and that the owner keeps the inverted uterus covered as much as possible with cloths. The operator now undresses sufficiently to have the arms bare and removes any closely fitting dress which interferes with free movements. The cow is now straightened—that is, placed upon the knees and hocks or upon the right side. Two strong men take care of the head, another one pulls the tail to one side. This is followed by

2. *Removal of the secundines.* When they are still adhering, it is always a proof that the owner has not attempted reposition. The removal of the afterbirth is very simple. The foetal placenta is stripped off each cotyledon with the thumb and index finger. After all cotyledons have been treated in this way the hand is passed into the slit-like opening leading into the empty horn, where the chorion is also separated from the cotyledons. The secundines are now removed, the inverted uterus rinsed with cold water and placed upon a clean cloth.

3. *The hind parts of the cow are raised,* or whenever possible she is induced to stand up. Anybody omitting this meets with difficulties. Many a young veterinarian found to his disadvantage that he omitted this, the first and most important rule of reposition. I am almost tempted to state that the balance of the treatment depends entirely on the execution of this rule. The greater the elevation of the hind parts of the cow, the easier the reposition. In the standing posture the conditions are very favorable, especially when the cow lies on the knees in front. Whenever possible the cow should be placed in that position, as it is the best one for the operator. While doing so the cow must be supported by placing a rope or sack under the sternum, to be held by two men, two more when supporting her behind in a similar manner without pushing the

belly up. When the cow is unable to stand or falls down constantly, thus exposing the uterus to injury, she is laid down and the hind parts raised. Many operators prefer to place the cow upon the right side, at the same time elevating her behind. I have also succeeded in practicing reposition in this way. In case this position is employed, the long axis of the cow and the floor should form an angle of 30 to 45 deg. The hind parts are easily raised by using bundles of straw, tied with three ropes, thus preventing the cow from sliding. In order to place the bundles easily, a girth is pushed under the body, two men on each side now raising the cow. An assistant puts the bundles in place while the veterinarian protects the inverted uterus from injury. Another simple method is the following: The cow is laid upon a door; a few men raise the door behind, placing the straw under it, thus elevating those parts (Harms, Göring).

As a result of the elevated state of the hind parts, the intestines slip forward, rendering reposition more easy. It is very reasonable, therefore, that many practitioners have proposed methods to render this important preparation more easy. Schmidt's method is very good. The animal rests upon the sternum, abdomen and hind legs flexed on the belly—that is, the posterior limbs are flexed in the tarsal joints so that the animal rests upon them and the posterior face of the metatarsal bones.

Others recommend to put the cow on the back and elevate the hind parts (Harms). For this purpose the thighs of the hind legs are corded and fastened to a strong stick placed transversely. Four men, two on each side, raise the cow while an assistant banks her up with bundles of straw. The cow, while in the dorsal position, may also be wound up as done by the butcher, the withers only touching the ground (Frauck). This is a pretty rough method, but in it reposition is easy. When reposition is impossible by any of the previously mentioned methods, this last named method may be practiced.

Reposition therefore is practiced in the standing cow—either resting on the knees or not—upon the right side with

the hind parts raised, or in the dorsal position with the hind parts elevated.

Reposition is not attempted when the cow lies on the left side, the cow being first rolled onto the right side. The diagonal position of the rumen explains sufficiently why reposition meets with great difficulties, or is even impossible, with the cow resting on the left side.

4. *Treatment of the prolapsed uterus previous to reposition.* Careful cleansing is indicated, best done with cold antiseptic solution of lysol or creolin; the cold at the same time stopping hemorrhages. The use of warm milk or oil is absolutely superfluous.

Quite some patience is necessary to clean the uterus thoroughly and to remove all bits of straw, etc., in the folds.

Small wounds are stitched with strong thread, the stitches going through the mucosa and muscularis. The edges of the wound are bent so that the edges of the mucous membranes project upward when the suture is completed. This assures apposition of both serosæ. Reposition must be done cautiously. As soon as the uterus is replaced, it contracts, thus rendering the wound smaller.

The uterus is next placed into an alum bath—that is, moistened for about ten minutes with a 2 or 3 per cent. alum solution. For this purpose 200 g. of alum are put into 10 l. of water. This treatment, first introduced by Weidenkeller in 1852, has the following advantages: The alum has antiseptic and astringent properties; the mucosa becomes rough, so that the surface of the prolapsed part is more readily grasped during reposition; the alum solution also causes the uterus to contract a little, thus diminishing it in size. The treatment may also be executed by enveloping the prolapsed uterus with cloths previously saturated in the alum solution. This alum treatment is very useful indeed.

After all preparations have been thus made, follows:

5. *Reposition.* It endeavors to return the inverted organ to the abdominal cavity. Many methods are employed, one using this one, others another one. Success mainly depends

on the fact that the preparations have been carefully performed. The method most commonly employed is that one where the operator begins at the opposite direction in which the prolapsus took place. The uterus for this purpose is again inverted upon itself.

*Modus operandi.*—The uterus is placed upon a sieve, or instead of it upon a broad cloth, and elevated by two assistants, one on the right and the other on the left side of the surgeon. After seeing that the uterus has not rotated around its long axis, occasionally the case when the cow is rolled, the fist, covered with a cloth, is placed against the most dependant part of the inversion, reinverting the uterus by slow and gradual pressure. While doing so the fist moves in the direction of the long axis of the impregnated horn toward the vulva. It is imperative to follow that direction. Those who practice reposition of the prolapsus uteri sometimes forget this rule, pushing the inverted uterus against the ischium, unable to proceed further; this also is apt to produce rupture.

While pushing the uterus further and further with the hand, one endeavors to advance as far as possible, especially when the cow does not strain. This pressure must be practised slowly and gently, and that portion of the uterus lying on the arm is seen to return gradually. It is frequently necessary to retract the hand, the arm being too short to advance further. In order to do so an assistant presses against the uterus while the operator's hand is retracted to take a new hold.

When the horn is reduced and the hand passed in as far as possible, the upper portion of the arm is still in contact with the prolapsed cervix vagina. To reduce them, two assistants press against the prolapsed parts on either side of the vulva with their hands protected by towels, reposition taking place usually quite easily in the intervals between the straining, the whole mass mostly slipping in all at once. During this operation the cow strains constantly; it may become so violent as to interfere greatly with reposition. Many practitioners very properly are of the opinion that the intervals of rest between

the pains should be used to advance the hand and perform reposition. Others recommend chloral hydrate per os (Pröger) or a whiskey narcotic.

Some practitioners perform reposition in a different manner. They grasp with both hands that part of the prolapsus next to the vulva, pushing it in, while assistants manipulate the remaining portion of the prolapsus similarly.

This method may be combined with the first one. After that portion close to the vulva has been returned, the fist is placed against the basis of the prolapsus, reducing the whole mass (Göring).

Coculet proposes a method to decrease materially the dimensions of the prolapsus previous to reposition, so that it is reduced with but little effort. After cleansing the uterus, it is wrapped in a piece of linen 1 m. long and 70 cm. wide. The uterus is now continually irrigated with warm water, drawing it tighter from minute to minute, thus diminishing its volume constantly. Reposition is readily effected after fifteen to twenty minutes.

This method, combined with the alum treatment, is to be recommended, as it saves a lot of work and decreases danger.

*After treatment.*—Reposition must be complete ; that is, care should be taken not to overlook partial inversions here and there, which induce straining and possibly a new prolapsus.

To prevent this the cow ought to be made to rise immediately after reposition. The hand is introduced into the uterus to smooth down any remaining wrinkles, which, as a rule, have disappeared by themselves. It is also well to walk the cow, as exercise is the best means to encourage complete reposition and to prevent straining.

When the cow is unable to rise, the hind parts should be raised and the hand remain in the uterus for ten to fifteen minutes. As long as the uterus is not completely descended into the abdominal cavity and it pushes continually against the hand, something is wrong. In those cases the hind parts are to be raised more yet, or she is to be made to stand, according to Johne's method (l. c.). Some recommend to fill the uterus

with fluid, as warm water or a weak lysol or creolin solution, to smooth down any wrinkles. For this purpose I suggest a 1 per cent. alum solution, provided no uterine wounds are present. After a complete reposition the cow does not strain any more, and should she continue to strain, an exploration must be made at once to correct any partial inversions.

It often happens that when the owner reduces the prolapsus himself the cow continues to strain in spite of all means employed to prevent it (curry-comb tied to the back, surcingle or bandage around belly), professional aid only being employed after a few days, when the general health becomes disturbed. Internal examination then reveals that an *inversio uteri* is present, cotyledons lying in the cervix or in the vagina.

In those cases the treatment is as follows: The well-oiled hand repels the inverted part, followed by immediate walking exercise of the cow. After that the uterus is irrigated once daily with a warm alum solution; when necessary, a pessary is employed.

The quicker the contraction of the uterus and closure of the cervix after reposition, the less the danger of a recurrence. Therefore, little pieces of ice are frequently introduced into the uterus to encourage contractions. The main point in the after treatment therefore consists in the prevention of a new prolapsus, most readily effected by a complete reposition. There are many means employed to prevent it, which may be divided into two main groups: (1) means which prevent *inversio uteri*; and (2) means which only prevent the expulsion of the prolapsed uterus from the vulva.

To the first group belong the pessaries. They prevent the inverted uterus from passing through the cervix into the vagina.

St. Cyr and Violet describe a simple pessary, termed by them Gariel's pessary, consisting of a rubber pouch and tube. The pouch is folded, introduced into the uterus, inflated and closed by means of a small stopcock. The whole is a modification of Willburg's pessary (Baumeister), he introducing a pig's bladder and inflating it.

St. Cyr and Violet state that the pig's bladder for this purpose was mentioned already in 1815 in the "Cours d'agriculture de l'able Rozier, II. ieme édit. Paris, 1815, Tome I, Article accouchement." Rainard reports that Greek veterinarians of the Roman Empire (300) already used a pig's bladder as a pessary for said purpose.

It is also possible to prevent the inverted uterus from passing into the vagina by tamponing the vagina. Already Chaber (1795) and Leblanc (1826) described pessaries for that purpose.



Fig. 75.—Rainard's Truss.

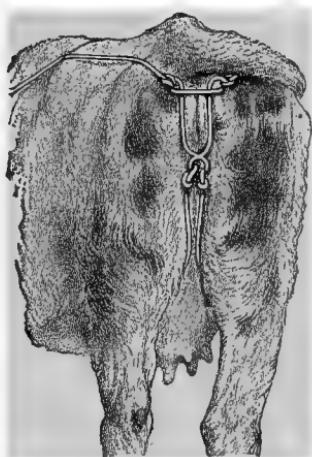


Fig. 76.—Lund's Iron Truss.

Also a stick with a knob, the latter enveloped with cloth, may be used as a pessary. The knob is introduced as far as the cervix, where it remains for some time. The end projecting from the vulva is fastened by means of two cords (one on each side) to a surcingle.

Pessaries may be dispensed with in our practice. In many cases they are a disadvantage, causing violent straining, metritis or injuries.

Among the means employed to prevent the prolapsed uterus from being expelled are: 1, suturing of the vulva (see *prolapsus vagina*); 2, trusses.

Trusses are variously shaped. They mostly consist of ropes lying on either side of the vulva and pressing against it, secured to a surcingle. The adjoining drawings show some of those employed (figs. 75, 77).

Lund constructed a very practical truss (fig. 76). Bräuer's truss is used in cows where the vulva and anus lie deeply between the ischial tuberosities. The instrument for this purpose is well concaved. Although these trusses are commonly used in practice, I prefer to suture the vulva. The latter is more likely to prevent a prolapsus, when the stitches are

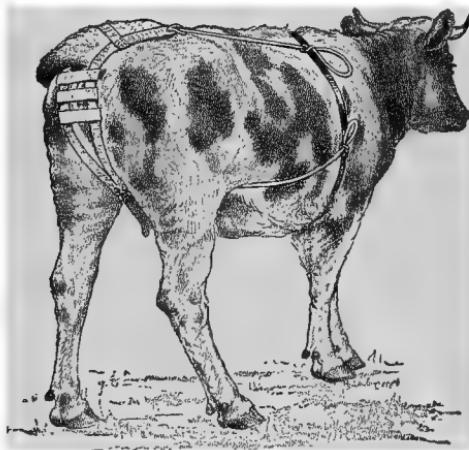


Fig. 77.—Truss commonly used in Holland.

inserted sufficiently far from the free border of the vulva, than trusses which are easily displaced and get loose when the cow strains, and it happens that a portion of the inverted uterus passes by the truss. Another great disadvantage of trusses is the fact that they must remain for several days, eventually becoming a mass of manure.

#### AMPUTATION OF THE UTERUS (AMPUTATIO UTERI).

*Indications.*—1. *Gangrene of the uterus.* Previous to this it was pointed out that not every black spot upon the uterine

mucosa should be looked upon as gangrene. A uterus prolapsed only a few hours is not yet gangrenous. At the same time it is found where prolapsus follows embryotomy, where the uterus was wounded, or where rough attempts at reposition of an abnormal presentation were made, in consequence of which the animal strains continually. At first an inversion occurs, possibly wedged in the cervix or vagina; finally prolapsus takes place. It also happens that reposition of a prolapse is followed on the next day by another one. In such cases gangrene is sometimes seen.

2. *Uterine wounds.* Large wounds or those produced by treads of a neighboring animal penetrating the three layers indicate amputation.

3. *Impossibility of reposition.* This indication is rare. In most cases—in fact, in all cases—reposition of the prolapsus is possible. Amputation is only then indicated when all methods have been employed in vain. As a rule the uterus is then in a condition where its reposition would endanger the life of the animal. Under such circumstances amputation is called for.

*Prognosis.*—When veterinary literature is consulted along this line, we notice that most animals stand the operation well. This deduction is not quite correct. The cow may stand amputatio uteri when artfully performed very well, and may suffer but little. But many cases are known where amputation was soon followed by severe disturbances, and even death. Some surgeons observed immediately after the operation great restlessness or paralysis of the hind parts. This usually lasted one half to one hour, eventually followed by improvement. I have seen such a state of excitement terminate fatally in one half hour. Prognosis therefore is doubtful.

*Modus operandi.*—Before the operation is performed we satisfy ourselves that the urinary bladder is empty and that no intestines are lodged in the prolapsed uterus. When necessary, the bladder is emptied, the intestines are put back into the abdominal cavity by raising the uterus and elevating the hind parts of the cow. On the whole, intestines are rarely pres-

ent in the uterus. In doubtful cases an incision is made and the parts explored with the hand.

The operation consists in ligating the prolapsus as a whole. For that purpose a broad ribbon is employed, placed around the cervix uteri with a surgical loop; a good-sized strong rubber tube may also be used.

Many empirics in Holland used a silk necktie for this purpose, tightening it around the cervix.

Two points must be observed: 1, the site of the ligature; 2, the tightening of the ligature.

Most operators ligate a few centimeters posterior to the palma plicata; only a few ligate the vagina. The first place is preferable, as there is no danger of including the urethra.

In order to tighten the ligature properly it is necessary that it be strong, so that two men can pull on it with all their power; and, on the other hand, that it is sufficiently broad to prevent cutting through the uterus.

The mass enclosed by the ligature is so large that it is somewhat difficult to cut off the entire circulation, which at the same time is absolutely necessary.

To accomplish this the two ends of the ligature are fastened one each to a stick, one man pulling on it steadily; some time being required before the parts are firmly constricted.

Traction ought to be exerted upon the cord steadily for one minute to squeeze out all the liquid from the uterus wall and to cut off the circulation completely.

Some suggested to circumcise the entire mucosa before applying the ligature, which would then include only the muscularis and serosa. This is not necessary, provided the ligature is tightened gradually and firmly, thus depriving the parts of any blood supply.

The elastic ligature may also be used to advantage. The rubber tube is wrapped around the parts several times and fastened in the ordinary way.

After ligating the uterus it is cut off 4 to 6 cm. from the ligature. Some practitioners wait twenty-four to thirty-eight hours before amputating it. This is only indicated when

danger exists that the ligature might slip off. When the ligature is applied properly, the uterus is severed and the stump replaced.

The after-treatment consists in douching the vagina with warm antiseptic solutions. The ligature drops off in fifteen to twenty days. Should prolapsus of the stump appear, the vulva is sutured when necessary.

Veterinarian de Vries at Zaltbommel (Holland) reports the following case. A cow which had calved normally retained the after-birth. Seven days later the owner, on entering the stable in the morning, found the uterus prolapsed and the decomposing secundines adhering to it. The uterine mucosa was dark red and on some places almost black. In consequence of venous stasis, considerable infiltration of the submucosa and muscularis had taken place, thus rendering the uterus enormously swollen. Reposition of the voluminous uterus was impossible, as there was danger of puncturing it with the hand, its powers of resistance being so little. De Vries therefore decided upon amputation. As a ligature a rope of pencil size was used. It was placed in the shape of a surgical loop around the folds of the cervix and tightened; in order to make it slip better the loop was dressed with soap. The ends of the ligature were secured to two sticks, on which two men pulled vigorously. To satisfy himself that no intestines were included by the loop he incised the uterus and introduced the hand. By holding the finger on the spot to be constricted he appreciated the complete strangulation of the parts. After tying the loop the uterus was severed 5 cm. posterior to it. The stump was placed into the pelvic cavity and the animal walked about. The cow swayed to and fro, rotating the tail furiously. These symptoms disappeared within an hour, and the cow began to eat. Next day the temperature was 38.5 deg. C., the lacteal secretion had diminished, but increased on the following day. The vagina was syringed with a 1 per cent. pyoctanin solution. For six weeks the animal discharged a limited muco-purulent excretion. The animal was kept as a milch cow for 1½ years and was then fattened.

#### 4.—Retention of the Afterbirth. Retentio Secundinarum.

*Causes.*—The expulsion of the secundines at the normal time may be retarded by various causes. The ætiology of this disease is of the greatest importance with regard to the various methods of treatment. Insufficient contraction of the uterus is probably the most common cause. While discussing the process of involution of the uterus the importance of uterine contraction as regards expulsion of the foetal membranes was shown. The agglutination of the foetal and maternal placentæ represents, as we know, the union between the foetal membranes and cotyledons. When the uterus does not contract, the villi of the placentæ maternæ do not become quite bloodless; therefore they remain slightly enlarged, retaining as a result the villi of the placentæ foetales. The union of course is not as intimate as at the time when the foetus existed in the uterus, since the foetal placentæ were also filled with blood. The immediate function of the uterus is also wanting, in consequence of which the surface of the uterus becomes smaller and the mucosa plicated. This inactivity of the uterus often depends on excessive dilatation, as met with in multiple pregnancy, hydrallantois and lardaceous calves. It may also follow exhaustion of the mother, as by long drives, or exhaustion of the uterus. The latter shows itself, for instance, when torsio uteri existed for several days before assistance was rendered. In such a case the secundinæ are mostly retained. In very fat cows the uterine contractions may be small after parturition, thus interfering with the expulsion of the afterbirth. Here the fatty infiltration of the muscularis is probably the cause of the limited contractility. The retention of the afterbirth is often the result of firm adhesions between the foetal and maternal placentæ (for instance, following a placen-titis). The placen-titis usually terminates with the production of connective tissue. This new growth extends only to a few cotyledons and then mostly to a portion of it. The contrac-

tions of the uterus are unable to sever the connective tissue adhesions of the placentæ thus formed. Firm union of the placentæ is also found in abortion at the seventh or eighth month of pregnancy. The union here is not always connective tissue; in fact, pathological changes in the placentæ foetales prevent separation.

A portion of the afterbirth may also be caught in the empty horn. This happens when the uterine contractions are very violent. A part of the membranes, especially a piece of the chorion, lies in the empty horn, where it has become united to the cotyledons. When the muscularis of the gravid horn contracts and the secundines are separated, their weight is sufficient to cause detachment of the foetal membranes in the empty horn. It may happen, when the uterine contractions are violent, that the slit-like opening leading into the unimpregnated horn becomes so narrow as to interfere with the expulsion of the secundines lying within it. At the same time the balance of the afterbirth is also kept back.

A closed cervix prevents expulsion of the foetal envelopes within the uterus. This is a frequent cause of *retentio secundinarum*. The membranes are separated but cannot be expelled; it is often seen in cows with pendulous bellies. Here the process of involution is so slow that the cervical canal begins to close before the uterus has fully contracted.

*Symptoms.*—The secundines may be partly separated and hang from the vulva; but it is possible that nothing is visible. Such animals mostly show but few symptoms, if any, during the first three days; nevertheless a disturbance may be noticeable previous to parturition (see "*inversio uteri*"). After three to five days that part of the secundines exposed to the air begins to decompose. This is not necessarily followed by a disturbed general health. It frequently happens that such cows are apparently healthy, only the lacteal secretion remains limited.

Now and then straining is seen—that is, abdominal pressure supports the uterine contractions and attempts at micturition. When a large amount of the secundines project from the

vulva, pressure is exerted upon the urethral opening, closing it more or less. In such a case the cow puts herself into such a position, with the back arched and the hind legs well under the body, that the opening is freed, rendering urination more easy.

Vaginal discharge sets in usually after a few days. It is a muco-purulent, chocolate colored mass, consisting principally of mucus, uterine milk, remains of foetal waters and blood. The less the uterine contractions the greater the accumulation of this fluid in the uterine cavity. Some animals, when the secundines are retained for some time, show a pustulous exanthema, especially on the udder and the inner face of the thighs. This exanthema occasionally follows normal parturition and abortion, disappearing generally in a few days.

#### SEQUELS.

1. The secundinæ adhere to the cotyledons *and may be expelled in about six days*, the uterus contracting after this time. The cow recovers after a muco-purulent liquid has been expelled for quite some time.

2. The secundinæ decompose, usually after five or six days; the part hanging from the vulva having started to putrefy before this time. Decomposition also spreads toward the uterus.

The presence of putrefactive bacteria in the secundines no longer in contact with vital parts, leads to the production of numerous toxines which may cause sapramia.

It often happens that the cow withstands the decomposition of the afterbirth. Of course the general health is somewhat disturbed, the cow does not feed well, yields but little milk, but no further phenomena are observed. After some time the afterbirth mixed with pus is expelled piecemeal, so that one may speak of a *maceration*.

3. Puerperal infection in the form of a septic or pyæmic infection. This is especially so in emphysematous foetuses delivered by embryotomy; possibly with injury to the genital canal. It is usually in these cases that the afterbirth is

retained on account of the excessive dilatation of the uterus and its insufficient contractility.

4. Tetanus, which is very rare, may follow retention of the secundines (Giovanoli, Röder.)

*Prognosis.*—It is pretty favorable, when proper assistance is rendered in time, but unfavorable when symptoms of puerperal infection are already present before assistance is requested.

*Therapeutics.*—Treatment must be preceded by an internal examination. The point here is not so much what may we do in *retentio secundinarum*, but what are its causes and how may we remove them.

The treatment *depends on the causes*, as they decide upon either a medicamentous or manual treatment. Some practitioners prefer the former, others the latter. Either one may yield good results. It is best to first conduct a thorough examination, letting the treatment depend on the cause detected.

It is not exactly an agreeable business to examine a cow with a decomposing afterbirth. The stench is often unbearable and hardly to be removed from the arm. Nevertheless it must be done. When somewhat careful we need not soil ourselves particularly. Of course it is understood that no good clothing is worn for this work. It is also a matter of course that any small wounds are well covered and that hands and arms are thoroughly oiled. Any negligence along this line exposes the operator to infection.

The purpose of the exploration is to detect: Atony of the uterus, firm adhesions between the foetal and maternal placentæ, whether caught in the empty horn (cornu) or closed cervical canal. Possibly a portion of the afterbirth passed through a perforating uterine wound into the abdominal cavity. All these are not difficult to recognize. When the uterus has not contracted sufficiently one feels during the examination only a few cotyledons close to the internal os uteri. The foetal placentæ are readily removed from them; those cotyledons further away are beyond reach of the hand.

While exploring, one may attempt to pull slightly on the secundines. For this purpose a part is seized with the whole hand and gentle traction exerted on them. In some cases this is successful; should it fail, it is indicated to induce uterine contractions. This may be tried variously: in the first place, by subcutaneous injection of extractum secalis. I have frequently seen good results from an injection of 6 g. extractum secalis cornuti, dissolved in 8 g. glycerine and 12 to 20 g. of water. This mixture is injected below the skin in one dose. In about four to six hours uterine contractions set in and the secundines are expelled unless other causes retain them. Contractions of the uterus may also be produced reflexly by friction of the abdominal parietes.

For this purpose the abdominal walls on either side are dressed with stimulating agents (ammonia, ol. terebinth and spirit of camphor ana. 60), followed by friction with straw wisps.

*Irrigations* with cold water are especially indicated to produce uterine contractions. When all other means fail, it may be tried.

When the cause of retention is a too firm union between the maternal and foetal placentæ, the means just mentioned are of no avail, and separation must be practiced in some other way. Should the examination reveal the cotyledons to be within reach of the hand, they are to be *separated with the fingers*. This is done as follows: Hand and arm of the operator are closely examined (eventual small wounds covered with elastic collodium), and then oiled with creolin oil (1 creolin to 10 to 20 of oil). In between times an assistant washes the vulva, tail and thighs. While the tail is held to the right the operator passes the right hand into the vagina through the cervix into the uterus. The left hand grasps the secundines unless already hanging from the vulva. The right hand follows the secundines into the impregnated horn. After its condition has been ascertained he begins to separate the foetal placentæ lying close to the internal os uteri. For this purpose he places the cotyledons between thumb and index finger, stripping the foetal

placenta from the cotyledons with the thumb. In this manner one goes from one cotyledon to the other, pushing the separated parts through the cervix and vagina into the left hand, so that they may be fixed without. Finally the foetal placentæ are stripped off the most distant cotyledons and the part of the chorion in the empty horn is also pulled out. Now the secundines are removed and the uterus syringed with an antiseptic solution; for instance, a one per cent. lysol or creolin solution. It is not always possible to remove the afterbirth in this way. When a new growth of connective tissue has followed a preceding placentitis, the separation of the foetal placentæ is impossible on some places, and there is danger that bits of the foetal membranes remain *in situ*. The latter is a dangerous thing, as it may lead to serious consequences. For this purpose a different line of treatment is indicated.

It consists in twice daily irrigating the uterus with a warm antiseptic solution; for instance, a 2 per cent. acidum boricum, 1 or 2 per cent. alum solution, or 1 per cent lysol solution. This prevents decomposition of the secundines and assists in an aseptic maceration of the foetal placentæ. Both methods—that is, irrigation of the uterus and manual separation—may be combined. While unbottoming the foetal placentæ their separation is more readily effected by introducing warm antiseptic solutions.

This operation is most successful when performed on the third or fourth day. In some cases it is possible to remove the afterbirth on the day following parturition; in some cases all cotyledons are not accessible within the first two days after birth. On the third or fourth day the uterus has contracted sufficiently so that all parts can be reached. Therefore one waits for this period, unless its immediate removal is indicated on account of *inversio uteri*, injuries to the uterus, vagina or vulva, inflammation of the parturient passage and violent straining.

In case a portion of the secundinæ is caught in the empty cornu, it is readily removed with the hand. On examination one feels the slit-like opening laterally in the wall of the once

pregnant horn. When the cervix uteri is closed, an attempt is made to open it by a rotary movement of the fingers, eventually passing the whole hand. This is usually successful with some persistence. It also happens that the secundines are detached and lie loosely in the uterus. They are removed by hand and the uterus flushed with warm antiseptic solutions.

A great number of antiseptics are employed in irrigations of the uterus; for instance: acidum boricum, acidum carbolicum, lysol, creolin, kalium permanganate, pyoctanin. The latter are less agreeable on account of their intensive color imparting itself to hands and arms.

*Bichloride of mercury* should not be used in the cow for this purpose; also acidum carbolicum is questionable on account of its penetrating or transmitting itself to the milk. At the same time it may produce intoxications when used freely (Van Leeuwen).

Many medicaments exist, employed with a view to expel the secundinæ. But twenty years ago herba sabinæ, kalium carbonicum, borax and flores chamomille were still used. They exert no action upon the uterus. Extractum hydrastis canadensis fluidum, recommended for this same purpose not so many years ago, also proved itself of no value (Albrecht).

### 5.—**Endometritis.**

By endometritis is understood an inflammation of the mucosa and submucosa of the uterus. This disease is almost exclusively met with after parturition and during the process of involution.

#### (a) ACUTE CATARRHAL ENDOMETRITIS.

*Aetiology.*—Injuries of the mucosa during birth as they may occur while correcting a malposition. It is more readily produced when manipulation with instruments in the uterus takes place, which have not been cleansed previously, or when cords not previously softened are employed. As long as the foetal waters have not been entirely discharged the danger of

injuries is less, as the uterus is closely moulded on the calf, the foetal waters acting as a protecting medium. A second cause is infection. Nothing definite is known with regard to the low organisms which cause endometritis. Its course only induces many to deal with this endometritis separately, and not include it in the group of "puerperal infections."

*Symptoms.*—In some cows the afterbirth is expelled in time, though mostly after twenty-four hours or later. This retarded expulsion is the result of a slow process of involution.

The general health is somewhat disturbed, appetite and rumination lessened; the cow strains occasionally; the temperature is usually normal; the quantity of milk has decreased. On internal examination on the third or fourth day after parturition, the cervix is still sufficiently opened to allow the hand to pass into the uterus.

The uterus is not contracted normally, but possesses a considerable lumen; the cotyledons have become smaller. Within the uterine cavity small pieces of the afterbirth are usually not met with, but a brown, slimy fluid, mostly inodorous. During the examination the cow strains, showing that she is suffering pain.

*Course.*—The course is usually favorable. After four to five days the uterus contracts, and from that moment the brownish fluid is discharged regularly. The appetite increases, rumination and lacteal secretion return, and the cow recovers. An examination after eight days reveals that the cervix is not entirely closed, but two or three fingers may be introduced, so that the lochiaæ can be evacuated properly.

*Therapeutics.*—In such animals the contraction of the uterus is of primary importance. The resorbing surface thus becomes smaller and the danger of an infection less. Contractions are induced by the subcutaneous injection of extractum secalis (5 g., the same amount of glycerine and water in one dose). Some veterinarians administer borax in pretty large quantities.

According to my experience, I can also recommend borax in endometritis. Irrigations of the uterus in this disease are

not necessary. When practiced by the veterinarian himself they are of value. For that purpose a warm 2 per cent. boric acid or 1 per cent. alum solution is employed. By using it at body temperature violent straining is to a great extent prevented.

(b) CHRONIC ENDOMETRITIS.

*Definition.*—A chronic inflammation of the mucosa and submucosa of the uterus, leading not only to considerable secretion, but also thickening of the uterine wall.

*Ætiology.*—Chronic endometritis may follow an acute one. Mostly it is due to certain agents in the uterine cavity acting as foreign bodies. As such may be considered: *Remains of the afterbirth* and retained not *aseptic lochia*. The latter often accumulates on account of closure of the cervical canal.

*Sequel.*—As the result of the irritation of the uterine mucosa, a muco-purulent secretion follows, which mixes with the contents of the uterus so that a considerable accumulation of fluid may arise. This fluid varies; in one case it is light-yellow and rather thin, then again resembles pus and mucus mixed, or ordinary pus; occasionally it is of a chocolate color. Depending on the type of the excretion, chronic endometritis has been termed variously to indicate the observed phenomena. Thus *hydrometra*, or dropsy of the uterus, is spoken of. The fluid is then mostly clear and watery, the quantity amounting to 10 to 20 l. or more. When the exudate within the uterus is purulent, one speaks of a *pyometra*. This trouble is often seen in the cow, usually being due to retention of the afterbirth. The amount of accumulated pus is frequently so great, that pregnancy is simulated. The mucosa of the uterus may undergo such changes that it resembles a granulating surface, these granulations protecting the organism against further infection.

*Symptoms and Course.*—At first chronic endometritis is characterized by insignificant symptoms. A few days after birth the general health is slightly disturbed, but eight to ten days later the cow apparently recovers. The owner nevertheless observes that the lacteal secretion is limited and that the

animal remains emaciated while feeding well. After this state of affairs has lasted some weeks, he occasionally notices in the stable behind the cow a muco-purulent mass, which on closer examination comes out of the vulva. The discharge may be so plentiful that a large amount is found every morning.

When the hand and arm are passed into the vagina the cervix is found apparently closed. The finger cannot enter and one possibly surmises the discharge of vaginal origin. This, of course, is incorrect. The fluid comes out of the uterus and is evacuated through the cervix by the uterine contractions, as the cervix easily opens by pressure from within outwards, but not in the opposite direction. On rectal examination the uterus filled with liquid often feels like an elastic ball. This disease, where quite an amount of pus or purulent mucus is discharged, is termed *leucorrhœa* or *fluor albus*. Such a state may persist for months, the cow gradually becoming emaciated, depending on the intensity and extent of the disease.

*Prognosis.*—This depends on the length of time the malady existed, as well as on any complications which may be present (see "Polyarthritis"). When the discharge is only of a few weeks' standing and the secretions become slimy, a favorable prognosis may be put; often recovery sets in without any treatment. An extensive pyometra, with subsequent marked emaciation, calls for an unfavorable prognosis.

*Therapeutics.*—This endeavors to evacuate the uterus and to induce contractions by local treatment with antiseptic and astringent means. The uterus is best emptied by mechanical dilatation of the cervical canal. This requires lots of patience and repeated manipulations. To treat the uterus locally, a straight catheter is passed into the uterus through the cervix, attaching on its free end a rubber tube and funnel. The uterine cavity is first flushed with warm water, followed by a 2 per cent. boric acid solution. After one or two days the uterus is irrigated with a 2 per cent. alum solution, to be repeated every other day. The injected fluid remains in the uterus for 10 to 15 minutes, when it is evacuated by lowering the rubber tube, this acting like a syphon. In this way decided improvement is

obtained in about three weeks. Of course even this method occasionally fails in very old cases.

When the cervical canal cannot be dilated from the vagina, and rectal examination proves the uterus excessively filled and distended, it may be punctured with a trocar through the abdominal parietes. It has frequently only a palliative effect—that is, the fluid can be evacuated but accumulates again—but cases are known where the animal improved greatly after tapping the uterus. The cow stands the operation well.

Wester (Holland) reports a case he observed in a cow where the cervical canal could not be opened at all. Rectal examination revealed the uterus greatly distended by fluid. On puncturing the uterus he evacuated 90 l. of stinking pus. Through a rubber tube and funnel attached to the cannula, a creolin solution was introduced into the uterus. After the liquid thus introduced had flowed off through the cannula the trocar was withdrawn and the abdominal wall vigorously compressed. After the operation the cow did not develop any peritonitis. In the following month the animal gradually improved. After that fluid again accumulated in the uterus. The animal became emaciated, so that the owner finally decided upon slaughter.

## 6.—Puerperal Infection.

### (a) SEPTIC INFECTION.

#### 1. *Puerperal Phlegmon.*

*Definition.*—By it is understood a phlegmonous inflammation of the vulva and vagina, arising during the puerperal state, characterized by extraordinary swelling.

*Ætiology.*—Infection during parturition. Small wounds on the labiæ or in the vagina are to be looked upon as the sources of infection. Almost at each birth, with or without manual interference, injuries of a superficial or intensive nature occur.

Bruises form especially favorable factors for infection. In the bruised tissues all around the wound the circulation is disturbed.

Thrombi are formed, offering a favorable medium for pathogenic micro-organisms (streptococci, bacillus of malignant œdema). The infectious material is often furnished by decomposing foetuses or foetal envelopes, but may also be introduced from without by manure, earth, dirty hands, etc.

Granulating wounds are often observed in the vagina and on the labiæ, while a decaying afterbirth is present at the same time. The granulating surface forms a protecting cover against many infectious substances.

*Symptoms.*—The first three days following parturition usually pass without any symptoms, so that everything seems to take a natural course. On the 4th or 5th day swelling of the vulva sets in, confining itself at first to the labiæ, on the following day extends over the anus, laterally forward over the posterior borders of the broad pelvic ligaments. The swelling may even extend to the flat of the thigh. The skin of the labiæ is glistening and tense, the mucous membrane yellowish red. A thin, yellowish fluid flows out of the vulva, dripping regularly from the lower commissure. The skin is tense as far as it is swollen; percussion gives a full sound. When the hand is passed over the swollen surface, crepitation is similar to symptomatic anthrax (black leg). The disease really resembles symptomatic anthrax very much, but when the swollen parts are incised subcutaneous and intermuscular accumulation of fetid gases is observed. The animal walks stiffly, appetite and rumination decrease. Defaecation and micturition are mechanically suppressed on account of the œdema. The urine is discharged in small quantities under violent straining. The faeces accumulate in the rectum, to be discharged now and then in the form of small, hard balls; occasionally it is of thin consistency. The temperature is 39 to 40 deg. C., the pulse at first normal, later accelerated.

Vaginal examination, quite difficult on account of the swelling, reveals necrosis of the mucous membrane of the vagina here and there, so that the necrotic tissue adheres to the hand and arm. The cervix uteri is usually partly open.

*Course and Prognosis.*—Most cases terminate fatally. The swelling increases, and after a few days death sets in, often quite unexpectedly.

*Treatment* in this disease is only slightly successful when the condition is still in its initial stage. When the swelling once extends over the sacrum and inner surface of the thighs, treatment is of little use.

Care should be taken that air is given a chance to enter the tissues, as there is no greater enemy for the bacilli of malignant œdema than air. For this purpose deep, long incisions are made into the most prominent portion of the swelling in the direction of the posterior border of the broad pelvic ligament.

Should the infiltration extend into the broad pelvic ligament and a communication exist with the vagina, a drainage-tube is introduced. The other side is treated in the same manner. Here one must not be knife-shy, but each canal must be searched for and split. The wounds are douched with a 2 to 3 per cent. carbolic acid solution.

Internally camphor and oleum terebinthina are given. The infection described as puerperal emphysematous anthrax has nothing common, according to Carl's investigations, with symptomatic anthrax, but is simply a septicæmia puerperalis of unknown genesis, in which the bacillus of malignant œdema produces symptomatic anthrax-like phenomena. The cases of puerperal phlegmon observed by me strongly resemble the cases described in the literature as puerperal emphysematous anthrax. Some of the cases terminated fatally in one to three days, but on the whole the processes extended over more time. That the swelling ever involved the whole body, I never observed.

## 2. *Metritis Septica.*

*Definition.*—Metritis septica is an inflammation of the mucosa and submucosa of the uterus, due to infection, accompanied by serious disturbances of the whole organisms, depending on the presence of toxines in the circulatory system.

*Etiology.*—The infection is usually produced by decomposing foetuses (emphysematous foetus) or secundines. It follows when low organisms enter through uterine wounds.

It seems that the venous thrombi met with during the process of involution offer a favorable medium for germs; from here poisonous agents may enter the circulation at any time, followed by serious symptoms of disease.

*Symptoms.*—Septic metritis, as a rule, sets in three or four days after parturition. In most cases the afterbirth is still united to the uterus. This is almost invariably so after the birth of emphysematous calves. The general health is very good the first few days following birth. A disturbed general health is observed on the third or fourth day, appetite diminishes, lacteal secretion decreases, the temperature rises (39.5-40.5 deg. C.), the pulse is often normal, at times slightly accelerated. The animal occasionally strains and moans. The right abdominal wall is sensitive to pressure.

The vulva, as a rule, is not swollen. On examination, the cervix is found open, so that the hand can be passed into the uterus. The parturient passage feels hot. In the uterus are found, besides remains of the afterbirth a fetid, chocolate colored liquid. Uterine involution is not far advanced. There is still a considerable lumen present. The mucosa is covered here and there with a croupous exudate.

*Pathological Anatomy.*—The decomposing afterbirth or its remains are still connected here and there with the cotyledons. It happens occasionally a diphtheritic exudate is found upon the cotyledons and between them. The cotyledons, same as in normal involution, have decreased in size and undergone fatty degeneration.

The uterine mucous membrane shows on many places hemorrhages in the shape of petechiæ, but also large, diffuse, red spots, especially in the fundus uteri. The submucosa is thickened and edematous. On section, a yellowish fluid is discharged. An exudate is also observed between the longitudinal and circular muscular layers. The serosa of the uterus shows punctiform hemorrhages. A gelatinous exudate is

noticed between the layers of the mesometrium and thrombi of rather firm consistency, in the *arcus uterini*. The lumbar glands are swollen.

The other parts of the cadaver exhibit the symptoms of a septicæmia.

*Course and Prognosis.*—Many animals suffering with septic metritis die with septicæmia; the rate of mortality is about 60 per cent.; of the remaining 40 per cent. one half may be counted among the chronic cases, in which a chronic metritis followed after the processes came to a standstill; the course of the latter is doubtful. The prognosis is also unfavorable. In case of recovery, improvement sets in already in a few days. A too rapid recovery need not be expected, nor do the symptoms indicate it, as experience teaches that death often sets in suddenly.

*Therapeutics.*—It endeavors: 1, to destroy the low organisms; 2, to increase the powers of resistance of the organism.

For the former, antiseptic irrigations of the uterus are used, such as 1 per cent. solutions of lysol, creolin, carbolic acid. Some practitioners prefer a 2 per cent. alum solution, others a 1 per cent. pyoktauin solution. In this treatment the main thing is to first flush the uterus with warm water before the medicaments are introduced by means of the rubber tube and funnel.

It is advisable to introduce 3 to 4 l. of the above named solutions each time, allowing it to flow out after ten minutes. To prevent any straining, the fluid must be of body temperature. The irrigations should be made once or twice daily. An important factor to limit the process is the contraction of the uterus. Should it be possible to produce uterine contractions, the resorbing surface becomes smaller and the danger of a general infection diminishes.

Internally such animals receive camphor with turpentine; antifebrin may be employed. I have occasionally seen good results follow the administration of salol.

### 3. *Acute Puerperal Septicæmia.*

*Definition.*—A septicæmia of an acute type, following parturition, its symptoms from the very outset predominating over any other. This septicæmia is of great importance from an obstetrical and hygienic point of view. The local disturbances in these cases are very limited, so that but few alterations of an insignificant nature are detected on post mortem and on microscopical examination of the uterus and vagina. Putrefaction is not necessarily present. This septicæmia occasionally is met with after puerperal phlegmon and septic metritis.

*Ætiology.*—Little is known of the infectious material causing acute puerperal septicæmia in the cow. In all probability streptococci play a great rôle in this disease.

Acute puerperal septicæmia occasionally follows difficult labor with injury to the parturient passage, and may be seen when birth takes place normally without manual interference.

The source of entrance for the infection are wounds ; often these are only simple epithelial defects, as they occur in every normal birth.

The infection may also take place by intermediaries ; for instance, the arm and hand of the obstetrician, instruments, ropes, also straw and stable paraphernalia.

I know cases of acute puerperal septicæmia, where no exploration had been made, which died, and where the infection only could have been transmitted by straw which had been used as bedding for a cow dead with puerperal septicæmia a few days previously. There are also cases known where cows died a few days after giving birth without any apparent cause, but slight assistance having been rendered them during parturition. Post mortem also failed to reveal any lesions which might throw light upon the cause of death. These mysterious cases only discontinued to appear after attention had been drawn to the transmission of the virulent agent, prevented after that by vigorous antiseptic measures.

*Symptoms.*—The disease sets in suddenly on the second

or third day after parturition. The symptom observed by the owner is the decrease in the lacteal secretion. Appetite has decreased or is wanting, rumination also. During the day other symptoms set in, as hurried respiration, and a more or less swaying gait behind. Cows standing in the stall often knuckle over in one hind leg.

Examination shows a body-temperature of 41 to 41.5 deg. C. The pulse is frequent, the eye dull; the animal strains occasionally and gives vent to a low moan. The conjunctiva is injected and slightly yellowish; the same refers to the mucosa of the labia. The vulva is swollen but little, if any.

In case epithelial defects were on the mucous membrane of the vulva or vagina, infection taking place through them, they now have changed into a puerperal ulcer. They are differentiated from ordinary ones by the fact that a diffuse redness is observed in their neighborhood. Close inspection is necessary to detect them upon the yellowish mucosa. Exploration usually reveals an open cervix. When the examination takes place on the third day after birth, two or three fingers, sometimes the whole hand, can be passed into the cervical canal. In the uterus fetid lochiaæ and remains of the afterbirth are sometimes found. Nevertheless, in those cases where parturition took a normal course and the foetal envelopes were expelled in time, the uterus only contains a small amount of an inodorous brownish liquid.

*Course and Prognosis.*—Acute puerperal septicæmia is a disease where a fatal termination is the rule and recovery a great exception. As soon as the first symptoms appear death follows often unexpectedly within one to three days.

*Pathological Anatomy.*—Such a cow when killed does not reveal satisfactory lesions on post mortem examination. Ostertag, therefore, correctly says that just the absence of serious lesions of the internal organs, respectively the insignificance of the changes, apparently out of proportion to the serious disturbances, observed intra vitum, should induce us to suspect sepsis.

In animals which succumbed to the disease the changes

are more marked. Already when the skin is removed the œdema shows the symptoms of septicæmia. The blood is fluid and not coagulated. The muscles appear as if boiled. The uterine mucosa sometimes shows the lesions of a septic metritis, but in many cases nothing but a slight infiltration of the submucosa, which may also be wanting, is noticed. The serosa of the uterus shows hemorrhage here and there. A glutinous exudate is occasionally observed between the layers of the mesometrium, the same possibly seen under the serosa of the uterus. The process of involution did not run a normal course, the uterus is not contracted as it should be in a normal state at this time. In the uterine cavity is found a limited amount of a chocolate colored fluid.

The peritoneum shows ecchymoses here and there. In some cases enteritis is met with. The liver shows parenchymatous degeneration, a symptom, at the same time less intense, observed in parturient paresis.

The spleen is soft and somewhat enlarged. The kidneys show fatty degeneration.

Petechiæ are found here and there upon the pleura, endo and epicardium. The lungs, leaving out hypostasis, are normal.

Occasionally cases of hemorrhagic pleuritis are observed.

*Therapeutics.*—When acute puerperal septicæmia is once diagnosed in a cow, treatment is of little use.

*Antiseptic irrigations of the uterus* may be tried and those agents used already mentioned under septic metritis.

It is advisable in these cases to give camphor dissolved in æther subcutaneously; also oleum terebinthina per os may be used, as well as alcohol. Many veterinarians give salicylate of soda, others antifebrin and borax.

*Prophylaxis* is of vital importance. Care should be exercised to prevent transmission of the infection from one cow to another one. For this purpose the following must be observed:

Arms and hands must be mechanically cleansed after rendering assistance during parturition or exploring for a retained afterbirth. This must first be washed with soap and warm water, next disinfected with a 2 per cent. creolin solution;

the finger nails must be cut short and any dirt under them removed.

Ropes used to deliver emphysematous calves or in cows succumbed to septicæmia should be destroyed. Wooden instruments are to be boiled, iron ones disinfected by flaming them. The greatest care must be bestowed upon the disinfection of the hands when any animals have been examined previously suffering with erysipelas or phlegmon, or when a post-mortem examination had been conducted.

When a case of septic infection occurs in a stable, all other pregnant animals should be removed to another stable to calve. The stall occupied by the patient is to be thoroughly disinfected.

I saw that a cow died with puerperal septicæmia due to *retentio secundinarum*. Fourteen days later a second cow died with the same disease (after the prolapsed uterus was readily returned). Although I told the owner to disinfect the stable and remove the remaining pregnant cows after the death of the first one, he paid no attention to my advice, and in about eight days a third cow died with puerperal septicæmia. In this cow birth was normal and the afterbirth was expelled in time. Since no cows calved after this last case, and they were put on pasture, the infection disappeared. In the following winter no puerperal septicæmia showed itself in this stable, although the owner did not disinfect the premises properly during the summer. Air and sunlight no doubt disinfected the stable.

(b) PYÆMIC INFECTION.

*Polyarthritis, metastatic synovitis and chronic parametritis* belong to this group.

1. *Polyarthritis.*

*Definition.*—Polyarthritis, which follows parturition, is an inflammation usually of several articulations, especially the tarsus and carpus, depending on infectious material from the uterus.

The disease may start from the synovial membrane or the

marrow tissue. In either case arthritis may be serous or purulent.

*Aetiology.*—The source of the infection is the uterus. The circulation carries the low organism as emboli through the veins to the right heart, then through the pulmonary circulation and systemic circulation into the capillaries of the bone marrow. That osteomyelitis may follow intravenous infections of the micrococci, without traumatism otherwise, Rodet's and Lexer's experiments show.

The infectious agents, same as in polyarthritis, due to infection of the navel, are carried by bits of thrombi into the circulation, where they float along until they are arrested in parts where the current is slow and the passage too narrow, now exerting their evil influence (Vogel).

During the first few days following parturition the uterus is an excellent medium for the development of low organisms; especially when parts of the placentæ have remained and decompose. How far these low organisms or their poisonous products are concerned in the production of polyarthritis is not yet decided. Vogel is of the opinion that those parts devoid of epithelium are the real source through which infection takes place. He also remarks that he was struck by the fact that he usually received a positive reply to the question whether a hemorrhage occurred at the time the foetal envelopes were expelled or whether bloody streaks were observed in the discharge. He therefore believes that most cases of puerperal arthritis depend on slight wounds. Strebler thinks that this arthritis is due to the resorption from the uterine cavity of putrid, septic, poisonous materials formed after parturition.

Polyarthritis is often seen in cows where the expulsion of the afterbirth is retarded, but also in cows apparently undergoing a normal process of involution. Another disease due to the same cause, often observed with puerperal arthritis, is mastitis of one half or quarter of the udder. Polyarthritis may also be a symptom of pyæmia.

*Symptoms.*—A few days after birth, usually on the sixth or eighth day, the cow walks stiffly. When in the stable the

owner observes that she rises only with difficulty. She seems to suffer a great deal of pain and lies down most of the time. The appetite, rumination and lacteal secretion have diminished. The temperature rises to 40-40.5 deg. C. On examination, the afterbirth is often found in the uterus, but sometimes it is already expelled. In the latter instance quite a quantity of chocolate colored secretions is discovered in the uterus, by no means always fetid; in fact, inodorous in many cases.

The painful joint is often recognized by the swelling. The hock is swollen at the epiphysis of the tibia. Palpation causes the animal decided pain. The capsular ligament is often tense, due to an over amount of synovia, especially noticeable on the anterior and internal aspect of the articulation.

When standing up the cow elevates the diseased leg, momentarily touches the ground with the toe of the claw, followed by immediate flexion, acting as if it causes her pain to rest the foot upon the floor. This symptom, characteristic in itself, is almost always present. In many cases the carpus is also diseased, either because the epiphysis of the radius is swollen and very painful, or on account of the distension of the upper capsular ligament.

When both joints are diseased, walking is very painful, and when the cow lies down, it is difficult to induce her to rise. The femoro-tibial articulation may also be involved: although it is rare to see it primarily diseased, it usually follows when the tarsus and carpus have been already attacked. In case the epiphyses are also involved emaciation sets in rapidly. Vogel states that in such cases turbid urine is passed, and that dyspnoea, oedema of the brisket and in front of the udder is met with, depending on internal metastasis (lungs, liver, kidneys).

*Course and Prognosis.*—When the disease is confined to a synovitis serosa the course is usually favorable, and complete recovery may follow in a few weeks even when the tarsus and carpus are implicated. Osteomyelitis, on the other hand, may be of an acute type, terminating fatally in four to six days,

but may take a subacute course accompanied with considerable changes in the joints, the animal dwindling down to a skeleton. In purulent arthritis, with periarticular abscesses or diffuse phlegmon in the neighborhood of the joint, prognosis is unfavorable.

*Pathological Anatomy.*—The vessels of the synovial membrane are injected, in more chronic cases thickened, and its surface rough. The synovia is of orange color, occasionally purulent. The tissues on the outside of the synovial membrane show a gelatinous infiltration, showing little purulent foci, which do not communicate with the joint.

The cartilage of the bony extremities is destroyed in the more chronic cases. In cases of osteomyelitis suppura-tiva, parts of the epiphysis are thrown off; the liquefied mass may perforate the bone at any place, giving rise to fistulous tracts (Vogel). On post mortem, multiple pus foci in the lungs and endocarditis are now and then observed.

*Therapeutics.*—When the secundinæ are not yet expelled, they must be removed and the uterus irrigated with a 1 per cent. lysol or creolin solution. Even when the afterbirth has been discharged and the os uteri still sufficiently dilated to pass the hand into the uterus, this irrigation must be practiced. The solution is best employed cold, to produce uterine contrac-tions, thus decreasing its resorbing surface.

The diseased joints are shaved, the skin soap-washed and scrubbed. Now Priessnitz fomentations of a 5 per cent. carbolic acid solution are made. This treatment, proposed by Vogel, has given excellent results in many cases. The joint is first covered with jute saturated in 5 per cent. carbolic acid water; over it is placed wet parchment paper, and over the whole an ordinary bandage. This dressing is renewed once daily. After five or six days vesicants or massage may be used.

Strebler orders the joint rubbed and massaged lightly three times daily with a weak volatile liniment. Münch saw good results from a 10 per cent. ichthyo-l-camphor salve. In the suppurative form Vogel recommends puncture with Paquelin's thermocautery, passing the red hot point directly into the bone.

Internally such animals may receive antiseptics, such as camphor with oleum terebinthina salve and salicylate of soda.

In purulent arthritis the principles of surgery come into play.

### 2. *Metastatic Synovitis.*

In most cases the sheaths of the flexor tendons on two or more legs are involved.

*Symptoms.*—The animal shows a stiff and painful walk. They lie a great deal, appetite has decreased, and the lacteal secretion is considerably less. Local examination reveals that the tendon sheaths are swollen, warm and painful. Metastatic synovitis may accompany polyarthritis or exist per se.

The *prognosis* is quite favorable when only one or two legs are diseased. Should all legs be involved, the danger of decubitus, especially in old, emaciated cows, is present. Prognosis in those cases is doubtful. In the latter instance a great deal may be done by timely interference.

*Therapeutics.*—When the os uteri is still open, antiseptic irrigations of the uterus are indicated; internally antiseptics are to be administered. The diseased sheaths are treated with Priessnitz fomentations. In cases of a chronic nature, massage with iodine ointment is indicated. In purulent inflammations the sheath must be opened, an incision being preferable to puncturing it with the trocar; that this is to be followed by an antiseptic dressing is necessarily a matter of course.

### 3. *Chronic Parametritis.*

*Aëtiology.*—Chronic parametritis is a chronic inflammation of the annexes of the uterus, which depend probably on a pyæmic infection from the uterus and in which the process localizes itself at first in the wall of the uterus and the mesometrium.

*Pathological Anatomy.*—The lymph vessels of the submucosa receive the infectious material, carrying it through the balance of the uterine wall and through the annexes as far as the lumbar glands, where further spread is often stopped.

Parametritis is often accompanied by considerable exudation into the muscularis and submucosa of the uterus. The inflammation also attacks the serosa of the uterus (perimetritis), so that even adhesions with the neighboring organs may take place.

The wall of the uterus thickens two to five times. Later multiple abcesses of pea to walnut size or single large abcesses form in the wall and possibly in the tissues of the pelvis.

*Symptoms.*—In the first few days after parturition the symptoms of an acute puerperal infection are manifested, usually due to a retained afterbirth. At that time the diagnosis is septic metritis. A few days after the afterbirth has been expelled or removed by hand, improvement apparently sets in. The owner nevertheless observes that the cow is not well, feeds poorly, ruminates slowly and that the lacteal secretion is limited. On examination the following phenomena are noticed: temperature 39 to 40 deg. C., pulse normal, respiration slightly accelerated. Defæcation is normal or thinner than usual. When such an animal is taken out of the stall, dragging of the hind legs so that the toes trip is conspicuous. Occasionally one hind leg is seen to knuckle over. Lameness or pain about a joint is not seen in the beginning. The latter are occasionally observed later in consequence of pyæmic metastasis. On exploration per vaginam the cervix is found closed, or when the examination is conducted in the first week after parturition, two fingers may be possibly passed. A few rotatory movements of the hand suffice to enter the uterus. The uterus is not contracted, its lumen is still quite large. As a result of this the lochiæ have accumulated and a brown, muco-purulent liquid is found in the uterus. Rectal examination also confirms the dilated state of the uterus.

The course is that of a chronic disease, followed occasionally by recovery, while at the same time chronic pyæmia is the more common termination.

*Prognosis* is unfavorable.

*Therapeutics.*—When the cervix is still open, antiseptic uterine irrigation must be made. To produce contraction of

the uterus a subcutaneous injection of extractum secalis (6 g.) is indicated. The internal administration of camphor with oil of turpentine also gives good results. In cases of long standing potassium iodide may be tried.

When abscesses form in the excavatio recto-vaginalis, occasionally the case, they are to be punctured with a trocar through the upper vaginal wall. To evacuate the pus, the hand passed into the rectum presses upon the abscess.

## 7.—Puerperal Intoxication.

### (a) INTOXICATION DUE TO RETAINED LOCHIÆ.

When the process of involution of the uterus is retarded, lochiæ accumulate in the uterine cavity. The latter may be aseptic, but obtain properties by chemical changes of great moment to the organism.

*Aetiology.*—Following the birth of twins, where the expulsion of the afterbirth was normal, as well as in fat cows, a retarded involution of the uterus with an aseptic uterine secretion is occasionally observed. In these cows the contractility of the uterus has been diminished by fatty infiltration.

Parturition was absolutely normal, so that no exploration occurred. The lochiæ, consisting mainly of uterine milk, blood and mucus, constitute an albuminous fluid, from which toxic agents may be formed by chemical changes, which are absorbed by the uterine mucous membrane and may give rise to symptoms of disease.

*Symptoms.*—Two or three days after normal birth the owner observes that the cow is dull, appetite is a little less, rumination is irregular, lacteal secretion gradually decreases. This state often persists several days before veterinary aid is requested, because the symptoms do not worry the owner. Besides these symptoms he notices slow defæcation and hard fæces, absence of lochial excretions. Temperature, pulse and respiration are normal.

The course is almost always favorable. Gradual improvement takes place in about eight days, even without treatment, without liberal excretion of the lochiæ. The lochiæ are partly resorbed. All this time the cow is slightly soporous; paretic phenomena are not observed.

*Therapeutics.*—It endeavors to induce contraction of the uterus and thus remove the cause of the intoxication. For this purpose ergot of rye is injected subcutaneously. In many cases the cervix is still sufficiently open that two fingers can be introduced. Nevertheless it is not advisable to practice its mechanical dilatation with subsequent irrigation of the uterus, as thus low organisms may reach the uterus, complicating matters.

I have frequently seen good results in such animals when given daily 3 gr. liquor ferri sesquichlorati in  $\frac{1}{2}$  l. of water per os.

(b) PUTRID PUERPERAL INTOXICATION, SAPRÆMIA.

*Definition.*—A putrid puerperal intoxication is an intoxication during the puerperal state (puerperium), due to poisonous agents coming from bacteria of putrefaction.

*Aetiology.*—Putrid intoxication results when the retained afterbirth decomposes. Toxines form in consequence of it in the uterus through the influence of putrefactive bacteria. The poisons taken up into the circulation produce violent toxic symptoms. This intoxication must not be confounded with septic metritis. In this disease not the slightest injury of the uterine mucosa need be present.

The healthy mucous membrane may take up the toxins. This disease frequently follows retention of the afterbirth. Intoxication of a slight degree is very common. The organisms at the same time have sufficient power to overcome them and to resist until the foetal envelopes are expelled. When many toxines have been produced this intoxication may be rapidly fatal.

*Symptoms.*—When the afterbirth is decomposing, appreciated by the stench, the animal begins to be dull and listless

about the fifth day. Appetite and rumination and the lacteal secretion have decreased; *temperature is normal*. Defæcation is usually a little slow; in that case diarrhoea follows later. The animal urinates frequently and in small quantities.

This state may last three to four days. When at that time the afterbirth is expelled or proper assistance given, the cause of the disease disappears and the animal regains its health.

But when the decomposing mass is retained, new toxines forming constantly, the amount of poison in the circulation may become so great that the picture of the disease changes suddenly and symptoms indicating a serious condition manifest themselves. The animal appears as if paralyzed, sways behind and occasionally remains in the recumbent position. A state of sopor sets in, appetite and rumination being suspended. The cow lies with the head to one side, producing expiratory moaning. This condition may last one day or only a few hours, death taking place quickly.

*Prognosis.*—In the beginning such animals can be saved. Whenever *sapræmia* is well established, prognosis must be unfavorable.

*Therapeutics.*—There are two indications: 1, produce evacuation of the uterus; 2, to induce contraction of the uterus.

The afterbirth is removed with the hand and the uterus thoroughly flushed. This treatment is not always easy. Sometimes it is necessary to dilate the cervix a little to pass the hand into the uterus.

The afterbirth often resembles detritus, lying in a chocolate colored fetid liquid.

After flushing with warm water the uterus may be irrigated with a 1 per cent. lysol or creolin solution. This treatment often is followed by immediate success. When sopor is present, spirits of camphor or camphor dissolved in ether, subcutaneously injected, may be indicated.

When pharyngeal paralysis is excluded an infusion of coffee with ether may be recommended.

## COMPARATIVE REVIEW.

SEPTIC METRITIS.	ACUTE PUEPERAL SEPTICÆMIA.	PUTRID PUEPERAL INTOXICATION.
1. Sets in on third or fourth day after birth.	Sets in two or three days after birth with symptoms of serious illness.	Sets in on fourth or fifth day after birth and even later.
2. Temperature 39.5 to 40.5° C.	Temperature up to 41.5° C.	Temperature normal.
3. Pulse normal or slightly accelerated.	Pulse and respiration frequent. Mucous membrane injected, slightly icteric.	Pulse normal.
4. The uterus contains a fetid chocolate colored liquid with remains of afterbirth.	The uterus occasionally contains a portion of the afterbirth. Puerperal ulcers are found upon the mucous membrane of the vagina and vulva. Putrefaction need not be present.	The uterus contains pieces of the afterbirth lying in a fetid brown fluid.
5. In 20 per cent. of the cases recovery may take place. The disease may also terminate fatally in four or five days or take a subacute course.	The course is fatal in almost all cases within one to three days.	Early treatment may be followed by recovery. Where sapraæmia is well established (serious illness with symptoms of paralysis) the course is usually unfavorable.

## 8.—Parturient Paresis.

By parturient paresis, a name originated by Schmidt-Mülheim, is understood a disease of the central nervous system, occurring in the cow during the first few days after parturition, rarely before or during birth. It is a disease characterized by an acute course, attacking mostly cows five to eight years old, and which have been fed well and are heavy milkers.

*History.*—J. G. Eberhard described this disease already in 1793 under the name of "Moerzickte." He gives a detailed

description of it in his treatise, "Verhandeling over het verlossen der Koeien" (treatise on bovine obstetrics); but his remarks show that he dealt both with parturient paresis and puerperal septicæmia. Jörg (1818) terms the disease *milk fever*. Mitchell gives a close description of it 1820. Binz (1830) designates it as *sporadic typhoid milk fever*. Rychner calls it *adynamia nervosa generalis*, Rainard *fièvre vitulaire*. Franck described the disease in 1876 as *eclampsia puerperalis*. He was the first one to separate parturient paresis from septicæmia puerperalis, thus putting an end to the confusion existing with regard to the two diseases.

Friedberger and Fröhner later differentiated between parturient paresis, septicæmia puerperalis and a mixed form, which offered clinically the symptoms of a parturient paresis but from an anatomo-pathological point of view the picture of a septic inflammation of the uterine mucosa. The existence of the latter form is undeniable, although rare. Among many diseased animals slaughtered I observed several times that the diagnosis "parturient paresis" was called for *intra vitam*, while the autopsy offered the picture of a septicæmia.

*Ætiology.*—There is no other disease the ætiology of which exhibits greater differences of opinion than this one; consequently a number of hypotheses exist, trying to explain it.

1. The hypothesis, according to which parturient paresis is due to *circulatory disturbances after parturition*.

Franck supposes that contraction of the uterus is followed by an increased pressure in the aorta in case the flow of blood to the udder and skin is interfered with. When these channels of the blood, which flows during pregnancy to the uterus, no longer are able to take up the increased amount, back pressure arises and with it an increase of pressure in the aorta. The latter produces cerebral congestion and œdema with subsequent cerebral anæmia. This process, according to Franck, is supported by: 1, cardiac hypertrophy; 2, plethora; 3, hydræmia.

Franck's theory has found many supporters, although some phenomena, such as the occurrence of parturient pro-

cesses before dilatation of the cervix and a sudden recovery, cannot be explained by it, nor is cerebral oedema always present on autopsy.

2. *Harms's theory.* According to Harms, the symptoms of parturient paresis are due to air bubbles in the blood (aeræmia). He supposes that the air enters through the veins of the uterus.

3. *The theory of autointoxication.* According to a generally accepted opinion, parturient paresis depends on poisons generated within the body and which have entered the circulation. The intoxication therefore looked upon as an autointoxication is said to be due to poisons (toxins) coming from the lochiaæ, milk and intestinal canal.

Schmidt-Mülheim supposes that a material is developed out of the lochiaæ by certain processes of decomposition quite different from putrefaction, which are analogous to sausage poison, when taken up by the blood produces serious symptoms of disease.

Freidberger and Fröhner adopted this theory and believe that the symptoms of parturient paresis, as well as the occasional cases previous to parturition—that is, about the time the cervix dilates—may be explained by it. In fact, the symptoms of parturient paresis (muscular paresis) resemble those of botulismus greatly.

Thomassen (Holland) thinks that the toxins are formed in the milk. Already in 1889 he wrote (*Rec. de méd. vét.*) that a correct theory as regards parturient paresis should explain :

1. Why this disease is peculiar to the bovine species.
2. Why it occurs especially at a certain age—that is, after the birth of the third calf.
3. Why exclusively in well fed animals (heavy milkers) which calved easily.
4. Why the disease occurs occasionally before birth and after parturition within 48 hours.
5. Why the disease develops so rapidly, disappears quickly without convalescence.

None of the known hypotheses fill these demands. The fifth question might be explained by the more and more

accepted view that the disease is due to intoxication—that is, autointoxication, in which the dose is fatal or not. In the latter instance nature soon gains the upper hand. But where does the poison originate? For at least ten years Thomassen supposes and thinks that it should be looked for in the milk, where toxins are formed from the albumen by the influence of low organisms. The amount of albumen in the colostrum is 15 to 20 per cent. (besides some sugar), soon drops to 2 per cent. and even less. This explains why the disease occurs occasionally before birth and mostly at a time when the third to seventh calf is born, at which time lacteal secretion is at its best.

In poorly nourished or sick animals (also in those which had difficult labor) the production of milk and albumen is less than normal.

In no animal is the milk after its secretion retained as long in the udder as in the cow, thus affording opportunity for the development of toxalbumens. In other animals the young empties the udder each time it sucks.

Are low organisms present in the udder?

Thomassen, already in 1893 and 1894, examined the fluid of the udder some time before parturition and always found diplo and streptococci. In fact, there is no animal in which low organisms find as readily entrance through the ducts of the teats as in the cow; in this animal infectious mastitis is also commonly observed.

Thomassen in 1893 experimented with the milk of cows suffering with parturient paresis, by injecting it into calves. He injected as much as 100 g. subcutaneously, but without any results. A point in favor of this hypothesis lies in the fact that milking previous to parturition as a prophylactic measure frequently gives good results, that the disease is almost unknown in localities where the calves suckle, that it is less common on pasture, where the danger of an infection is decreased, than in the stable. Nevertheless, the above named bacteria should not be held responsible, as others may enter just as readily. This explains also why several successive cases appear in one and the same stable.

Albrecht and Ostertag suppose that the symptoms of intoxication are due to leucomaines.

Eber looks upon parturient paresis as a toxigen disease. The toxigen also forms in the parturient passages of a parent which remains healthy, the toxigen being excreted as such. As a result of metabolism it is supposed to be changed into a real poison in the diseased ones.

Kaiser believes that the poisonous agent forms in the intestinal tract, being primarily a nerve poison and secondarily a muscle poison.

Ehrhardt also believes in the theory of autointoxication. According to him, parturient paresis is a chronic autointoxication, developing acute clinical symptoms as a result of parturition.

It depends on: 1. An increased accumulation of poisons, products of metabolism in the latter stage of pregnancy. 2. On a decreased elimination during the period colostrum is secreted. The fact that the parent becomes seriously ill in consequence of the intoxication, and the calf is born alive in cases where the disease shows itself before or during parturition, Ehrhardt explains by the antitoxic action of the thymus gland, which paralyses the effects of the ptomaines in the foetus.

4. *Intoxications due to products of metabolism of low organisms.* Guillebeau and Hess found, in eight autopsies on cows dead with paresis, four times a serous phlegmon of the uterus, twice lacerations of the cervix uteri, twice necrosis of the muscles behind the bony pelvis. In all these cases the puerperal state took a normal course, so that injuries of the parturient passages seemed excluded. According to Guillebeau and Hess, a close relationship exists between labor pains and serous phlegmon of the uterus and over-distention and bruising of the mucous membrane of this organ by hard parts of the foetus. Such a bruised spot would afford a proper medium for the accumulation of bacteria. They believe that the infection is caused by micro-organisms quite common to the vaginal mucous membrane, as the bacillus cedematis.

maligni, the bacillus bovis morbi ficans (Forster), and others. According to these authors, they may also emigrate from the intestines.

Nocard examined many uteri of cows dead with parturient paresis and studied bacteria of the uterine secretions. He always found staphylococci, and thinks that these microbes play an important rôle in the pathogenesis of parturient paresis. He thinks that the symptoms are due to the toxins formed by those low organisms. He refers further to Nicolaier's bacilli, which do not cause severe disturbances on the spot occupied by them while the action of their toxins nevertheless is exceedingly virulent.

*History.*—Parturient paresis almost exclusively occurs in cows which have calved three or more times. Most of them have had the fourth or fifth calf. This disease, although less frequent, is also observed in old cows.

By far the most of the patients are in good flesh; fat cows even seen predisposed to the disease. Emaciated animals, when heavy milkers, may also suffer with this disease after parturition. As a rule, easy normal birth precedes. When the disease sets in before or during parturition the pains are feeble and often insufficient to expel the foetus, so that they must be assisted by traction on the young.

Many observers have noticed that the disease is more frequent in some families than others. Its heredity is not yet established, although some observations point in that direction.

Most cases of parturient paresis occur twelve to forty-eight hours after parturition. This disease occasionally manifests itself previous to parturition (Albrecht, Andersen, Mattel, Meltzer, Monsarrat, de Bruin). My statistics, published already in 1887, mentions among the seventy-four cases of parturient paresis, one case eight days before birth, two cases three days before and three cases during parturition; seven cases one to six hours, twenty-two cases six to twelve hours, six cases twelve to eighteen hours, twenty-two cases eighteen to twenty-four hours, and eleven cases twenty-four to twenty-eight hours after parturition.

It has been frequently observed that a cow which recovered from parturient paresis was predisposed to it at the succeeding birth. Of the seventy-four above mentioned cows six had the disease the year previous, some which calved later several times escaped the disease. Gassner mentions a cow which had parturient paresis three times in succession. I also observed such a case.

In localities where the animals are heavily fed and great milkers the disease is more common than in parts where food and lacteal secretions are limited.

*Symptoms.*—In case the disease sets in during parturition, the feeble pains first attract the attention of the owner. The presentation of the calf is usually normal, so that but little force is required to finish birth.

In most cases parturition is easy and takes a normal course, and the afterbirth is expelled in time. In those seventy-four cases the afterbirth was retained in only four of them at the time of the attack.

The first symptoms are: diminished appetite, decreased or hard defæcation and weakness of the hind legs. The latter shows itself by the fact that the animal paddles with the hind legs.

When these symptoms have persisted for several hours the weakness of the hind legs increases. Cows which are out on pasture show a swaying walk and often remain on the same place for quite some time.

In stall-fed animals this persistent standing is also seen; they are afraid to lie down.

Finally, when paresis of the hind legs becomes well advanced, the animal is unable to stand up any longer and falls down. Sometimes the animal attempts to rise with a great effort, and when successful will stand with the hind legs spread far apart, leaning against the wall. This only lasts a few minutes, when it collapses, not to rise for the present.

The cow is now in the stage when the veterinarian is usually called. On examination the following phenomena are noticed, which may be divided into three groups:

1. *Symptoms of depression.* In the ordinary course the animal is soporous, lies flat on the thorax, or upon the knees with the head turned to one side. Now and then it moans. Occasionally the animal is restless, kicks with the feet and shows symptoms of great excitement. The latter are bellowing and vain attempts to rise, often throwing the head so violently against the wall that the horns are fractured. At the outset tonic spasms of the extensors of the back are sometimes seen (opisthotonus). My experience teaches me that these last symptoms call for an unfavorable prognosis.

2. *Symptoms of paralysis.* These manifest themselves not only in the voluntary muscles, but also partly in the non-striated muscles. Paralysis of peripheral nerves also occurs frequently.

The hindquarters always are the first to become paralyzed, followed by paralysis of the muscularis of the rumen, intestines and urinary bladder. This paralysis is characterized by the cessation of the rumen's peristaltic movement (frequently tympanitis), retarded, often hard, defæcation (the fæces in the rectum appear like plates, with bloody streaks, or may resemble peat), and by accumulation of the urine, as the detrusor urinæ muscle cannot contract sufficiently. In many cases, therefore, the distended urinary bladder can be felt on rectal examination and emptied by slight pressure. The urine sometimes contains sugar, first shown by Nocard. Albrecht found among twenty-five samples of urine only three with sugar and eleven with albumen.

In parturient paresis, almost invariably symptoms of paralysis of the vagus are observed, such as slow and deep respiration, frequent pulse and dysphagia. Dysphagia is a symptom of special importance from a therapeutic point of view. Since the pharynx and soft palate are paralyzed, medicaments (solutions or mixtures) given per os may enter the trachea and cause death by setting up a deglutition pneumonia. Small amounts of gastric contents may also be brought up by belching and enter the trachea. In many animals dropping of the upper eye-lid (ptosis) is observed occasionally; also par-

alysis of the orbicularis muscle (lagophthalmos). When the optic nerve is paralyzed, which also occurs, the animal is *totally blind*.

In very serious cases paralysis of the trigeminus also sets in. The inferior maxilla hangs down, the tongue may also hang from the mouth; since the saliva cannot be swallowed, it flows continuously from the mouth.

3. *Disturbed sensibility.* Sensibility has materially decreased. In serious cases the animals do not react to irritants, even needle pricks upon the legs or back. The *cornea* may be so insensitive that the animal does not react when touched with the tip of the finger. It may even appear wrinkled.

The temperature of the body is normal. Rectal temperature is usually below normal, since the paralysis of the sphincter makes a correct measurement impossible.

Under the influence of the outer air an apparently very low temperature may be present; but when the thermometer is introduced sufficiently deep, normal temperature is observed (Thomassen, Kruyt, and others). The temperature is unequally distributed. Ears and horns, muffle and extremities are usually icy cold.

As the disease advances the cow becomes utterly paralyzed and insensible. She lies on her side, moaning loudly; lacteal secretion is suspended. Parturient paresis may be complicated with prolapsus uteri. This is occasionally seen in cows taken sick immediately after parturition, lying low with the hind quarters.

#### COURSE AND DURATION OF THE DISEASE.

These cases terminate fatally in six hours after the first symptoms become apparent. As a rule it takes longer (twelve to eighteen hours). During this time the symptoms may increase in intensity until death sets in, or improvement may take place at any time.

It is a peculiar fact, that in some cows seriously ill, improvement sets in suddenly; remarkable instances are known.

In my former practice parturient paresis was common. Especially in villages along the Maas, where very fine and heavy milkers were raised in the bottoms, it was the fear of the farmers. It caused such damage that a mutual insurance company especially for milk cows was established. To save as much as possible the animals were slaughtered early, waiting at the same time as long as possible. It sometimes happened that the butcher with the knife in his hand waited for the last breath, when improvement set in suddenly, the cow rising a few hours later.

One cow suffering with parturient paresis I found on repeated visits to grow worse and worse, expecting death at any moment. Two hours later she stood in her stall, was lively and had some appetite. Nevertheless, such cases are very rare. At the same time they show how quickly nerve poisons are excreted, supposed to play here an important rôle.

It happens that cows with parturient paresis show improvement in 36 to 48 hours, the eyelids open, dysphagia diminishes. The animal drinks when a pail with water is held under the mouth, defæcation and micturition return. The general health improves steadily; in the following days it eats and ruminates. Paralysis of the hind legs occasionally disappears after two or three days. The cow rises as usual, without showing any disturbances, or sways a little on account of the paresis of certain groups of muscles. The latter involves usually the extensor muscles of one or both hind legs, so that the animal knuckles over a little; this disappears after a while.

But there are also cases where the animal apparently recovered, but cannot rise for days afterwards. Examination of the hind legs shows the thigh and hock of a hind leg swollen and œdematosus. From the thigh to the shin-bone the leg is twice or three times its ordinary size. The swelling is not painful, it distinctly pits on pressure. The leg cannot be moved. On post-mortem examination, dry gangrene of the gastrocnemius, biceps, femoris, and semi-tendinous is revealed.

Guillebeau and Hess observed two cases of necrosis of the deep tibial muscles. In all probability it is the same condition

observed by many veterinarians in some parts of Gelderland (Holland), and also by myself.

Guillebeau and Hess look upon this necrosis as a consequence of the continuous compression of the arteria femoris profunda during the preliminary and expulsive period.

A complication, setting in six to ten days after the animal shows already signs of improvement, is gangrene of one posterior extremity. Some veterinarians in Holland observed it, and Thomassen first described it in the Rec. de méd. vét. of August 15, 1889. The first symptoms are a swelling above the claws. After two days the cleft is moist and a fetid brown fluid appears all around the coronet. Soon a line of demarcation forms above the fetlock around the lower extremity of the metatarsus. The peripheral parts have undergone dry necrosis. Dry necrosis of the teats (mummification) is also seen occasionally.

As sequels, are occasionally observed: Paralysis of the œsophagus, ischiatic nerve, paralysis of one fore leg, which soon atrophies, and, very rarely, paralysis of the optic nerve.

A very disagreeable complication is the foreign body pneumonia. It often follows administration of medicines, but also regurgitation of gastric contents at a time when paralysis of the œsophagus and pharynx have not yet entirely disappeared.

*Prognosis.*—The sooner the disease sets in after birth, the more intense the symptoms become within a few hours, the more unfavorable the prognosis. The prognosis is also unfavorable when the disease sets in before or during parturition. Those six cases mentioned in my statistics terminated fatally.

Paralysis of the soft palate and complete unconsciousness are unfavorable symptoms from a prognostic point of view. The return of the lacteal secretion and defæcation (the latter not always) are often the first indications of improvement. Gangrene of the extremities demands immediate slaughter. The rate of mortality in this disease is very great. Statisticians give a rather high percentage; for instance: Franck, 40 per

cent.; St. Cyr and Violet, 50 per cent.; Göring, 48 per cent.; Ehrhardt, 50 per cent.; and in my statistics, 66 per cent.

#### PATHOLOGICAL ANATOMY.

Post mortem examination reveals a contracted uterus and the symptoms of a normal process of involution. The large intestines are usually filled with dry faeces; no inflammation is present. Those cases in which inflammation of the small intestines is observed in all probability depend on puerperal infection (see further down).

The omasum contains a great deal of dry food. The liver is always of a lighter color, but this is also met with in cows slaughtered for other reasons—for instance, in cases of fatal hemorrhage due to rupture of the uterus. The kidneys are mostly normal; occasionally parenchymatous inflammation is noticed. The large bronchi sometimes contain some feed; some animals show a foreign body pneumonia. The deep muscles of the thigh are occasionally necrotic (Guillebeau and Hess).

The changes in the brain are variable. Harms (also Bormann) found small round air bubbles in the veins of the pia mater.

In some autopsies large quantities of transparent serum were found under the dura mater and in the ventricles. (Harms, van Dulm).

Van Dulm and Hannel observed decided injection of the cerebral vessel, with extravasation, in consequence of which the cerebral substance exhibited a hemorrhagic infiltration.

Most autopsies are conducted on slaughtered cows. Thus the bleeding gives a more favorable anatomo-pathological picture, than if the animal had died. This must be given due consideration when the meat is to be consumed. There are also cases of acute puerperal septicæmia in which the uterus shows but few microscopic changes. The latter are often very dangerous, as the following case shows:

On October 17, 1890, in the morning at 10 o'clock, S. at V. requested me to visit his cow. She had given birth to her

fifth calf and was in fine condition. An easy and normal birth took place six hours previous to my arrival. The calf was alive. The afterbirth was still connected with the uterus. The cow exhibited the following symptoms: appetite and rumination were suspended, lacteal secretion limited, faeces hard; the cow swayed to and fro and threatened to fall down at any moment. After the weakness of the hind quarters had greatly increased, within a few hours the animal fell down, not to rise again. She was lying on her knees, the head resting against the thorax, moaning loudly. The vulva was not swollen. Diagnosis—Parturient paresis. The afterbirth was expelled during the afternoon while the cow was comatous. Toward evening the symptoms became so intense that the animal had to be killed.

The autopsy was held on the following morning. The uterus revealed no metritis, the brown, slimy lochia were perfectly inodorous. The serosa was normal; the involution corresponded to the post partum stage; the liver was slightly yellowish, but very consistent; the spleen normal. The colon normal filled, its contents rather dry. The small intestines were filled with thin, brown manure, the mucous membrane injected, here and there small hemorrhages; the submucosa was somewhat swollen; the vessels of the serosa were injected. The kidneys were normal, having a few petechiae in the cortical layer. The lungs were collapsed, slight hypostasis on the left side, bronchi and trachea normal. The endocardium near the valves and the valves themselves were covered with a few petechiae. The vessels of the pia mater were distended; the ventricles contained a transparent liquid.

I condemned the meat mainly on account of the enteritis, fearing that possibly an acute septicæmia might have existed, while the anatomo-pathological picture was hardly sufficiently pronounced to confirm such a diagnosis.

Before the meat could be destroyed some meat from the hind quarters was sent to a neighboring family, who had cooked and ate it. All who had partaken of this meat became ill with acute gastro-enteritis (one party even

with bloody diarrhœa). After a few days all the patients recovered.

*Therapeutics.*—It is natural that in a disease of which the aetiology is so dark, the methods of treatment are numerous, the curative agents multiple, and the results of their administration variable.

*Prophylaxis.*—Experience teaches us that extensive feeding and a long period of dryness in cows calving for the third, fourth, or more times, predisposes to the disease. Therefore many advise to give fat, lymphatic animals in the last stage of pregnancy intensive but not voluminous food, and to shorten the period of dryness as much as possible.

In case pregnant animals are out on pasture in the summer, they should not be brought into the stable to calve, but parturition is best allowed to take place in the open air. Many stock owners through practical experience live up to this rule.

Thomassen, Walther and others recommend as prophylaxis to milk fat cows and heavy milkers before birth. Venesection on the day previous to parturition, the administration of purgatives, for instance, Epsom salts, are also suggested as prophylactic agents. While practicing in localities where parturient paresis was common, venesection was often practiced. I have never seen any evil results from it or large doses of Epsom salts.

#### STANDARD RULES IN THE TREATMENT OF PARTURIENT PARESIS.

The cow must lie straight, that is, upon the flexed knees and hocks, and a little on the right side. In this position tympanitis often disappears, quite marked while lying flat on the side. When the animal is too restless to stay in the straight position the body must be banked with bundles of straw. The animal must always be watched. It happened that a cow which moved forward, wedged the head into a corner and suffocated.

The urine is to be drawn from the bladder. Ordinarily it suffices to pass the finger into the urethral opening; when necessary, the catheter is used. Also by pressing upon the urinary bladder from the rectum it may be evacuated.

The manure accumulated in the rectum is removed with the oiled hand.

*Repeated milking.* The cow is to be milked every three or four hours. Rubbing of the back and loins with stimulating medicaments, as linimentum volatile, linimentum ammoniato-camphoratum, etc. The legs are rubbed with straw wisps to stimulate cutaneous circulation. The number of medicinal agents employed in parturient paresis is very great. On account of the paralysis of the soft plate and danger of a deglutition (pneumonia), it is not advisable to drench such animals. Only when personally convinced that the animal can swallow and giving the medicine ourselves, drenching is permissible.

#### MEDICINAL AGENTS FOR SUBCUTANEOUS INJECTION.

Here excitants are indicated, as alcohol, ether, spiritus camphoratus, caffein. In case the hind quarters remain paralytic for some time, strychnia is used.

*Cocaine* (1 g. to 10 g. aqua) has been used subcutaneously with success.

Bauwens employed nitroglycerin in parturient paresis internally and subcutaneously. The subcutaneous application (5 gr. of 1 per cent. solution in alcohol) yielded good results.

Medicaments influencing involuntary muscles are frequently employed in this disease, as eserine, pilocarpin, arecolin and veratrin; especially pilocarpin gave good results (Haubold, Anker and others). Hürlimann injects 20-30 g. of pure ammonia on either side of the neck. He orders the animals taken into the open air and irrigates the uterus with a warm disinfecting solution.

*Rectal medications*, such as cold water clysters, solutions of Glauber salt and sodium chloride, are named. Some recommend a decoction of tobacco.

*Hydrotherapy.* Hydrotherapy is frequently practiced in parturient paresis. Hartenstein saw very good results follow the irrigation of the cranium and spinal column with cold water. For this purpose a linen sack was put upon the head and loins

and kept moist with water. He also practices venesection, giving a purgative (aloe 30 g., asafœtida 10 g.).

Priessnitz's fomentations are also often used. Ehrhardt advises to cover the body with a wet linen cloth and over it woolen blankets. The fomentation is renewed every hour.

Venesection is practiced in this disease by many veterinarians (Hartenstein, Ehrhardt, etc.). Electricity has also been employed a few times.

Anker (Holland), who treats every year many cases of parturient paresis, follows a method by which the rate of mortality decreased materially in localities where he practiced. It is as follows: The position of the cow must be a natural one, not upon the thorax but on the knees. Subcutaneously 300 to 500 mg. pilocarpin are injected. A sack is laid upon the loins and continuously kept wet with *cold water*. When the animal is restless the head also is cooled. By keeping the loins and cranium cool the animal becomes quiet. When dysphagia is present he avoids drenching. When deglutition is normal a drench of herba nicotina with aloe and Glauber salts is administered. Twelve to fifteen hours after the first injection another 300 to 350 mg. of pilocarpin are injected subcutaneously. The animal is changed alternately from one side to the other and milked. When the disease has disappeared so far that the animal after three to twenty-four hours eats, drinks and ruminates, but does not rise, it is assisted in getting up, and the legs washed with cold water. Anker lays special stress upon the fact that the animal is assisted to get up, as it should not be omitted. He never saw any evil results follow the cold irrigations.

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## DISEASES OF THE YOUNG CALF.

### 1.—**Asphyxia Neonatorum.**

It happens now and then that the calf is born in an asphyxic state. This condition occurs when the foetal blood is wanting in oxygen, respectively laden with carbon dioxide.

*Aetiology.*—1. *Violent uterine contractions* during the preliminary and expulsive stage. As a consequence of an early rupture of the foetal membranes, the uterus contracts, the placental circulation is disturbed, so that death of the calf may follow insufficient blood supply.

2. *Retarded expulsion.* When head and fore legs are in the pelvis, the allantoic fluid is mostly discharged and the uterus contracted to a certain extent. Should disturbances be present in the parent or young, interfering with birth at this moment, the blood supply from the placental vessels is no longer sufficient, and dyspnoea results.

When one-half of the calf is born—that is, when the anterior half of the body is born—and the trochanteric diameter lies in front of the pelvic inlet, or when in the croup presentation the hind legs lie in the parturient passage, the navel string usually tears quickly and the placental blood supply ceases, dyspnoea being the result of a retarded birth.

3. *Inpiration of amniotic fluid.* Compression or rupture of the navel string causes inspiratory movements. In consequence of it amniotic fluid, especially in the croup presentation, may enter the air passages, thus interfering with the entrance of air.

*Symptoms.*—When the calf is born, the owner is soon inclined to look upon it as dead in case no inspiratory movements are noticeable. Nevertheless it is possible that the young animal can be saved by proper treatment. In most cases of asphyxia respiration immediately after birth is deep and slow, with long intervals. The heart's action often is very weak. Movements of the voluntary muscles are frequently wanting. This state may persist for ten to fifteen minutes; when respiration becomes less deep and slow, the heart's action becomes stronger and some inspiratory movements with a rattling noise manifest themselves. During the asphyxic state death may occur at any moment.

*Therapeutics.*—First the amniotic fluid must be removed from the mouth. This is best done with the fingers. Often the tenacious slime can be removed in the shape of a long

stopper. The treatment proper endeavors to stimulate the respiratory centre reflexly.

This may be done: (a) By irritation of the cutaneous nerves by rubbing the skin with straw wisps, or by carrying the wet calf immediately into the open air. Although stock owners object, it is nevertheless an active irritant. (b) By the application of cold water to the cranium between the ears or upon the umbilicus. This is simply done by allowing a stream of water from a height of 1 meter to fall upon those parts. (c) By artificial respiration (Albrecht). This should be continued for some time, five to ten minutes and possibly longer. (d) By electricity. Franck and Albrecht advise to place the electrodes close to the first ribs (irritation of the phrenic nerve). (e) By strong, rhythmical traction on the tongue.

Mytile tried the method, successfully practiced by Laborde, to revive the apparently dead, drowned ones, on an apparently dead calf. After pulling a few times a strong hiccough was heard, eventually turning into regular respiratory movements after a few more pulls.

Bauwens gives  $\frac{1}{2}$  g. of 1 per cent. nitro-glycerin solution subcutaneously and practices artificial respiration.

## 2.—Persistence of the Urachus.

When the navel string is torn the fundus of the urinary bladder closes and the urine no longer flows through the urachus. Occasionally it happens that this physiological process is disturbed, and in consequence of it the urine drips from the umbilical opening.

The *diagnosis* is easy. The umbilicus is hot and swollen; the hair all around the umbilical opening is wet and sticks together. When of some standing the hair of the anterior and inner surface of the hind legs drops out and the skin becomes inflamed. The opening leading to the urinary bladder is just wide enough to allow the passage of an ordinary probe. The edges are slightly elevated and exhibit a granulating seam.

*Prognosis* is favorable.

*Therapeutics*.—The purse suture is the simplest means to obliterate the opening. The opening may also be closed by searing, using a probe pointed iron at white heat. A more persistent eschar may be produced by putting some colophonium over the opening before searing it.

Cauterization with lunar caustic or copper sulphate is also successful in many cases.

### 3.—Fatal Enzootics of Calves.

This designation comprises several diseases differing in causes, symptoms and course. Of these the four principal infectious diseases are: dysentery, septic pleuro-pneumonia of Poels, septicæmia of Jensen, and bacteriamia (hemorrhagic nephritis and cystitis) of Thomassen.

#### (a) CALF DYSENTERY.

Calf dysentery (yellow or white dysentery, *dysenteria neonatorum*) is an infectious disease attacking the young animal in the first few days after birth, showing usually an acute, frequently fatal, course.

*Aetiology*.—Already Franck describes this disease as an infectious one, and supposes that a stable miasma must be looked upon as the cause. The fact that some calves are already diseased before they suck suggests that such calves were already infected before birth.

Nocard showed that *dysenteria neonatorum* and the infectious abortion in all probability are caused by one and the same low organism (see infectious abortion, page 115).

Besides Franck and Nocard, Friedberger and Fröhner also believe in intrauterine infection. The latter are of the opinion that infectious catarrhs of the uterus or vagina are transmitted to the mucosa of the digestive tract of the young.

Jensen thinks that there is hardly foundation to prove intr-uterine or vaginal infection. Jensen found an oval bacterium in the blood, mesenteric glands, spleen, also in the

liquid of the kidneys, liver and lungs, obtained by squeezing them, finally in the blood of the heart. Especially in sections of the spleen and kidneys the bacterium was found lying in little masses in the smaller vessels.

Jensen further states that when he fed a culture of the oval bacterium in milk to a newly born calf or one but a few days old, this dysentery ended in death in one or two days.

According to Jensen, the calf dysentery bacteria are oval, a little larger than the microbes of chicken cholera, lying singly or in pairs, occasionally forming short chains. They do not take Gram's stain, but stain with ordinary aniline colors. They are facultative parasites and are related to the *bacterium coli communis* and *bacillus foetidus lactis*, also described by Jensen.

Jensen came to the following conclusions based upon his investigations: Calf dysentery is not a simple inflammatory state of the digestive canal, but an inflammation complicated by a septic state produced by the entrance of bacteria into the circulation.

The cause of the disease is not a specific infectious agent, but a pathogenic variety of a form of bacteria normally found in the intestinal contents.

Piana found a microorganism in the blood, the intestines and in the lumbar portion of the spinal cord supposed to be identical with the *bacillus coli communis*. His experiments with these cultures remained negative. He believes that the cultures rapidly lose their virulence, or that the calves have greater powers of resistance a few days after birth.

Monti and Veratti also believe that the short bacilli (1.2 x 0.7  $\mu$ ), found in this disease, are closely related to the bacilli.

Galli-Valerio mentions that Piana and Monti, as well as Veratti, Mazzanti and Vigezzi (the latter found in the umbilical vessels, intestines, liver and brain, an oval micrococcus or diplococcus of 0.0015 x 0.0008 mm.), probably dealt with a variety of *bac. coli communis*.

The investigations of Walther and Schild prove that bacteria may be found in the intestinal contents of the new-

born before they have taken nourishment. According to his opinion, the first infection of the intestinal contents takes place independently of food by various bacteria, also peptonizing ones. At the earliest infection occurs four hours, at the latest twenty hours, on an average ten to seventeen hours, after parturition. He also proved that in a child infection per anum is due to the bacillus fluorescens, the porcelain coccus, the bacillus subtilis and proteus; infection per os is caused by the bacterium coli and the bacillus fluorescens liquefaciens.

*Symptoms.*—In some cases the owner observes a few hours after birth, but in most cases one or two days, that the calf strains slightly and exhibits some tenesmus, and that the faeces are thin. The liquid faeces in the beginning are yellow, sometimes orange colored and fetid. Later the manure is discharged involuntarily, is gray like slate dust, and thin as water. Suckling is limited or entirely suspended. The calf is soporous, the muffle, the ears and extremities are cold, the walking swaying. At a later stage the eyes sink back into the orbital cavities, and 12 to 24 hours, occasionally 36 to 48 hours, from the beginning of the diarrhoea death takes place.

Jensen mentions as Mörkeberg's observation that the disease sets in with severe stretching at times of a distinctly convulsive character. The rate of mortality in this disease is very great. Friedberger and Fröhner give it as 80 to 100 per cent.

*Pathological anatomy.*—Pathological changes are found in the abomasum, intestinal canal and heart. According to Jensen's description, the gastric mucous membrane is injected and full of small hemorrhages. The mucous membranes of the small intestines, caecum and colon are mostly of a uniform red color, due to numerous small hemorrhages; here and there desquamated epithelium is observed. The folds of the rectal mucosa are especially hyperæmic. The mesenteric glands are swollen and exhibit hemorrhagic infiltration. The spleen is normal, the liver and kidneys somewhat hyperæmic. The heart shows occasionally ecchymoses. This picture agrees

fully with the alterations noticed by many investigators of this disease. Sometimes pneumonic foci, deglutition pneumonia were found (Mörkeberg, cited by Jensen).

*Therapeutics.*—Prophylaxis promises here more than therapeutics. Franck already in 1876 advises to place pregnant cows, four to six weeks before their term is up, into another stable, the floor of which has been disinfected previously. Goring, besides, suggests thoroughly cleansing the abdomen and the legs of such animals, and to wash their udder with a 2 per cent. carbolic acid solution and to take care the infectious material is not transmitted by an intermediary.

Mörkeberg decreased the rate of mortality from 77 to 33.3 per cent. by analogous measures and by feeding pure milk from an udder first washed with sublimate water. The young animals are treated with antiseptics (1 to 1200), creolin, naphthalin, thioform, salicylate of soda and salts of bismuth.

Some practitioners had good results by administering slimy agents with opium (mucilago saleb with opium). Many use the remedy recommended by Hertwig, magnes. carb., pulv. rad. Rhei and pulv. opii; also tannic acid and silver nitrate ( $\frac{1}{2}$  per cent.) are used either per os or as clysma.

No matter which remedies are employed, it is always of importance to keep the calves warm and to stimulate cutaneous circulation by rubbing with straw wisps.

#### (b) SEPTIC PLEUROPNEUMONIA OF CALVES.

Poels first described this disease, quite common among calves. It has the character of a septicæmia complicating itself with pneumonia and pleurisy. Poels found in this disease specific bacteria, pure cultures of which produced the identical disease in experimental calves. On post-mortem examination of these experimental calves the bacteria in pure cultures, virulent and in large quantities, were found in the blood, internal organs, pleuritic and pneumonic exudates.

The pure cultures killed mice, rabbits, guinea pigs and young bovines. In swine they may produce a disease resembling closely swine plague.

The cultures and their pathogenic effects simulate strongly the bacteria of rabbit septicæmia (Gaffky), septicæmia hemorrhagica and swine plague.

The bacteria of septic pleuropneumonia may enter through the diseased digestive canal and through the umbilicus (as well at the time of birth, when the umbilical vessels tear, as in omphalitis).

Poels also states that these micro-organisms may live some time in the umbilical vessels. When the thrombus in these vessels undergoes putrefaction, the danger of a general infection becomes marked. In these cases it may happen that nothing abnormal is noticeable in the umbilicus.

Infection may also take place through the organs of respiration and excoriations of the skin.

*Prophylaxis.*—Poels recommends the following: Calves with diarrhoea must only be fed boiled milk during this disease. The milk vessels must not be cleansed with unboiled water from ditches or brooks, as practiced by some farmers; the putrid liquid discharged from the vagina in cases of septic metritis must also be taken care of. The animals easily infect the udder with the tail, from where the bacteria get into the milk pail when the animal is milked. This fluid sometimes contains the bacteria of septic pleuropneumonia. Therefore it is certainly indicated to keep the udder clean, respectively cleanse it mechanically with soap and warm water.

The umbilicus during and immediately after birth must also be treated antiseptically.

(c) CALF SEPTICÆMIA (JANSEN).

Jensen observed a disease among calves in Denmark. The specific cause, according to his investigation, is an ovoid bacterium. These correspond morphologically and biologically with the microbes of chicken cholera, septicæmia hemorrhagica (Kitt), and swine plague. Only their pathogenic properties show differences. According to Jensen, it is closely related to Poel's pleuropneumonia, but runs a more acute course without showing any inflammatory processes in the lungs. The calves

die within 12 to 24 hours after the first symptoms of the disease become manifest. These are sudden illness, the animals are unable to stand, the temperature is very high, about 41 deg. in some cases; there is dyspnoea and diarrhoea.

The autopsy in some calves revealed a violent acute fibrinous pleuritis and peritonitis, also gastro enteritis and numerous ecchymoses under the pericardium; a tumefied spleen and gelatinous infiltration about the larynx and pharynx; often also a phlegmonous inflammation of the posterior portion of the buccal cavity was found (Jensen).

(d) BACTERÆMIA (HEMORRHAGIC NEPTRITIS AND CYSTITIS),  
(THOMASSEN).

*Etiology.*—The cause of this disease is a short bacillus found by Thomassen, resembling in form the bacillus typhi of man, as also the bacterium coli commune. From the latter it is distinguished by its great virulence. Even known pathogenic coli bacteria, as found by Jensen in calf dysentery, are not as virulent as this bacillus.

It is differentiated from the bacillus coli communis by: (a) its greater mobility; (b) its peculiar growth on potatoes; (c) its limited power to form carbon in saccharin bouillon and to develop indol out of pepton; (d) its inability to coagulate milk even in weeks; (e) the absence of fetid air on opening dishes in which gelatin plate cultures developed for some time.

Thomassen produced the disease experimentally with pure cultures either by subcutaneous inoculation or feeding of bouillon cultures. The following I have taken from his description:

*Symptoms.*—The calves are born healthy, showing the first symptoms in five to eight days, occasionally some weeks, after birth. They become listless, lie down all the time, and when forced to rise, they stretch, tucking in at the same time back and loins.

The muffle is dry; respiration frequent, 50 to 120 per minute; the pulse is small, 100 to 150 beats per minute; temperature 104 to 108 deg. F.

Some animals exhibit occasionally a severe and dry cough. The appetite has decreased, but the animal takes a little milk up to the last day.

Fæces are normal, rarely diarrhoea. The urine is evacuated frequently and in small quantities. It was mostly turbid, and contained albumen, bladder epithelium, casts and the above named bacteria.

Some calves show cerebral symptoms, as tonic and chronic spasms. Later paralysis sets in.

*Course.*—The disease extends over five to six days, always terminating in death.

*Pathological anatomy.*—The spleen is five to six times its normal size, weighs 1 pound, it is full of blood, of chocolate or black color. The spleen occasionally is irregular in shape when one part is more swollen than another one. A smear made from the spleen shows many bacilli. The kidneys show a hemorrhagic, parenchymatous inflammation. The mucosa of the bladder is colored brownish-red or sometimes in streaks or spots.

The mesenteric glands are enlarged, exhibiting many hemorrhages. The folds of the abomasum show dark red spots, also seen here and there on the mucous membrane of the small intestines. Peyer's patches are swollen. The liver is undergoing parenchymatous degeneration. The endocardium is covered with many red spots. The central nervous system is mostly normal. Occasionally a meningitis serosa, and in the exudate bacilli and leucocytes, are found.

*Therapeutics.*—Thomassen tried successively: carbolic acid 2 per cent., eucalyptol (1 to 10 in oil), ioditrichloride (1 to 1000, as much as  $2\frac{1}{2}$  ounces daily) and Lygol's solution subcutaneously and intravenously, without any results whatsoever.



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